

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PCT-2018-034		FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/IB2019/053881	International filing date (<i>day/month/year</i>) 10-05-2019	Priority date (<i>day/month/year</i>) 10-05-2018	
International Patent Classification (IPC) or national classification and IPC C05G3/06 Version=2020.01			
Applicant SAWANT, ARUN, VADAKEKUTTU, THANKAPAN			

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of <u>9</u> sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: a. ☒ (<i>sent to the applicant and to the International Bureau</i>) a total of <u>39</u> sheets, as follows: ☒ sheets of the description, claims and/or drawings which have been amended and/or sheets containing rectifications authorized by this Authority, unless those sheets were superseded or cancelled, and any accompanying letters (see Rules 46.5, 66.8, 70.16, 91.2, and Section 607 of the Administrative Instructions). ☐ sheets containing rectifications, where the decision was made by this Authority not to take them into account because they were not authorized by or notified to this Authority at the time when this Authority began to draw up this report, and any accompanying letters (Rules 66.4bis, 70.2(e), 70.16 and 91.2). ☐ superseded sheets and any accompanying letters, where this Authority either considers that the superseding sheets contain an amendment that goes beyond the disclosure in the international application as filed, or the superseding sheets were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in item 4 of Box No. I and the Supplemental Box (see Rule 70.16(b)). b. ☐ (<i>sent to the International Bureau only</i>) a total of (indicate type and number of electronic carrier(s)) _____ containing a sequence listing, in the form of an Annex C/ST.25 text file, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3ter of Annex C of the Administrative Instructions). 4. This report contains indications relating to the following items: ☒ Box No. I Basis of the report ☐ Box No. II Priority ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability ☐ Box No. IV Lack of unity of invention ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement ☐ Box No. VI Certain documents cited ☐ Box No. VII Certain defects in the international application ☒ Box No. VIII Certain observations on the international application
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Date of submission of the demand 07-11-2019	Date of completion of this report 11-06-2020
Name and mailing address of the IPEA/ Indian Patent Office Plot No. 32, Sector 14, Dwarka, New Delhi - 110075 Facsimile No.	Authorized officer Komal Choudhary Telephone No. +91-1125300200

Box No. I Basis of the report

1. With regard to the **language**, this report is based on:

- ☒ the international application in the language in which it was filed.
- ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of:
- ☐ international search (Rules 12.3(a) and 23.1(b)).
- ☐ publication of the international application (Rule 12.4(a)).
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a) and (b)).

2. With regard to the **elements** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

- ☐ the international application as originally filed/furnished, or
- ☒ the description: pages **1 - 81** _____ as originally filed/furnished.
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☒ the claims: Nos. **1 - 24, 27 - 29** _____ as originally filed/furnished.
- Nos.* _____ as amended (together with any statement) under Article 19
- Nos.* **25 - 26** _____ received by this Authority on **07 - 11 - 2019**
- ☒ the drawings: pages **1** _____ as originally filed/furnished.
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____

☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____

5. ☐ This report has been established:

- ☐ taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.1(d-bis) and 70.2(e)).
- ☐ without taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91(Rules 66.4bis and 70.2(e)).

6. With regard to top-up searches (Rules 66.1ter and 70.2(f)):

- ☐ A top-up search was carried out by this Authority on _____
- ☐ Additional relevant documents have been discovered during the top-up search.
- ☒ No top-up search was carried out by this Authority because it would serve no useful purpose.

7. ☐ Supplementary international search report(s) from Authority(ies) _____ has/have been received and taken into account in establishing this report (Rule 45bis.8(b) and (c)).

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IB2019/053881

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-29</u>	YES
	Claims	<u>NONE</u>	NO
Inventive step (IS)	Claims	<u>NONE</u>	YES
	Claims	<u>1-29</u>	NO
Industrial applicability (IA)	Claims	<u>1-29</u>	YES
	Claims	<u>NONE</u>	NO

2. Citations and explanations (Rule 70.7)

The applicant filed a demand for International Preliminary Examination dated 07.11.2019 along with originally filed documents under Article 34. The documents filed by the applicant dated 07.11.2019 has been duly considered. In reply to the amendments under article 34, IPEA-408 has been generated on 03.02.2020. Based on that, the applicant has submitted a formal response of IPEA-408, which has been duly considered.

However, the reply was not found persuasive in view of the observations communicated via the IPEA-408. Upon re-evaluation of the claims 1-29 under Article 33 of PCT, it was concluded by this authority that they do not meet the requirements of PCT Article 33(3).

Reference is made to earlier cited documents:

D1: US6749659 B1 (ENERSUL INC) 15 JUNE 2004 (15.06.2004)

D2: US2017283334 A1 (SUN CHEMICAL CORP) 5 OCTOBER 2017 (05.10.2017)

In the response to the IPEA-408 dated 03/03/2020, the applicant submits that there is no teaching in D1 to formulate sulphur, manganese in the form of water dispersible granular composition wherein the actives are present in specific concentration with defined particle size, as claimed. However, the office disagrees with this view as mere difference in particle size or concentration may not be considered as the technical advancement in the sense of Article 33(3) of PCT.

It is to be noted that D1 clearly mentions use of sulfur (claim 1) and manganese (see col 9, ln 40) granules of fertilizer. The objective of D1 is also to cater to crop protection and fortification with an added advantage of controlled release into pallet form in the heavy rainfall, which is not present in alleged invention. D1 clearly described that the formulations containing

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

1. Claims of the instant application are lacking in clarity in sense of Article 6 of PCT with respect to the unclear term/phrase like 'at least one'. The said term is vague and open-ended and incorporates several possibilities not yet explored by the applicant, therefore said claims are unclear and leave the reader in doubt as to the meaning of the technical feature to which they refer.

2. "Pesticidal active" claimed in claim 21, it comprises "antifoulants, attractants, insecticides, fungicides, herbicides, nematocides, etc.", but it covers large number of agrochemical compounds, moreover description does not disclose at least one working example from all these Pesticidal actives, therefore it is vague.

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Continuation of Citation and Explanation(Box5)

micronutrients may be based on the use of the oxide form of such species e.g. ZnO, CuO, MnO etc.. Release of these finely divided oxide materials from the Sulfur/clay granule, pastille or other particle form is controlled by the swelling action breakdown of the incorporated clay (see col.10, lines 46-52). So, D1 also provides a homogeneous distribution of fertilizer for crop protection as claimed in present application.

The applicant further states that sulfur and manganese are among many options present in the list of nutrient list and that there is no specific example disclosing the same in cited document D1. However, D1 clearly mentions the use of uniform and controlled sulfur (claim 1) and manganese in oxide or sulfate form (see col. 9, line 40). Further, D1 states that the released oxide forms, however, are not readily soluble in the soil environment and their up-take by the plant system is often dependent on actual plant root contact with the released oxide particle. It is for this reason that oxy-sulfate or sulfate forms of the micro nutrients Species such as Zn/Cu/Mn etc. are preferred. These more soluble and thus more plant available forms are used in micro nutrient fertilizer programs (see col.10, lines 53-59). By way of example, D1 further states a fertilizer formulation using copper/zinc/manganese/boron as the micronutrients (see col.9, lines 25-41).

Furthermore, the applicant has mentioned various commercially available treatments T3 and T4 in the comparative study, which means that the use of sulfur and manganese is a common practice in crop fertilizers.

Moreover, the data represented in the table 2 for the comparison respectively in the grain yield of Soybean, does not showed a surprising effect i.e. 10.47% and 9.4% increase is not a big change as compared to the commercial treatment with sulphur and manganese dioxide pastille composition.

Similarly, the applicant demonstrate a physical distinction data's in figure IA and figure 2A of Annexure A between the water dispersible granules of the present invention and the pastilles similar to those disclosed in D1 and D2.

But, D1 clearly mentioned that "during heavy rainfall or irrigation, water soluble fertilizers may be washed away before they have a chance to be absorbed by the plant. This results not only in a marked loss of efficiency but it also has serious environmental consequences. The presence of the swelling clay in the solid sulfur particle accelerates the breakdown of the solid sulfur into the small particulate size distribution that favours subsequent microbiological conversion of the sulfur to plant nutrient sulfate. Cheap and available elemental sulfur can thus be used to control the rate of release of sulfur into the soil. It can greatly reduce the amount of applied fertilizer material that

escapes into the aqua sphere causing pollution of waterways. It can improve the uptake of fertilizer plant nutrient material by better timing the release to match plant needs". It can also help keep the fertilizer nutrients in the root growing Zone of the Soil and minimize Sequestration by adsorption at deeper levels where it is unavailable to the plant (see col.1, lines 50-67).

It is also to be noted that D2 in claim 1 clearly mentions liquid micronutrient fertilizer composition comprising an aqueous dispersion of soluble and insoluble micronutrients (such as elemental sulfur, 1-80% by wt.; claims 1,3,5) wherein insoluble micronutrient may be present as a particle (d50 in the range of 0.1 to 10 m)(see para[0018]). The soluble micronutrient comprises manganese salts, 0.5-25 wt.% (see claims 2,4). The composition also comprises of excipients such as pH adjusters, rheology modifiers (see paras [0009-0012]).

Also, the compositions disclosed in examples of D2 are in paste form, which can be simply adjusted to form an aqueous suspension simply by addition of water. The same has been mentioned in every example of D2. This means that the composition disclosed in D2 is a water dispersion granular composition used for crop nutrition and fortification comprising elemental sulphur in a specific concentration; at least one manganese salt, its complexes, derivatives or mixtures thereof in a specific concentration; excipients. So, the combining teachings of D1 and D2, would be sufficient to arrive at present claimed matter.

The rapid release of micronutrients disclosed in D2 is a common feature with present application as mentioned by the applicant. Further, the particle size of insoluble micronutrient in D2 has been mentioned as 0.1 to 10 m (d50). The applicant has shown in comparative examples the effect of particle size on crop yield. Particle size mentioned in D2 is less than that mentioned in present application, which suggests a better crop yield as per the trend suggested by the applicant. Also, the applicant does not specifically mentions excipients and pesticidal actives (such as dispersing agents, wetting agents, etc.). Thus, claims become very broad and it is not clearly mentioned by the applicant which component/what causes this surprising effect in a composition with same components.

Thus, the response to the International Search Report (ISR/IPEA) corresponding to PCT application no. PCT/IB2018/053251 received but the subject matter of claims 1-29 of present application still fails to meet the requirement of article 33(3) of PCT because the subject matter of claims lacks inventive step article 33(3) of PCT.

Novelty under PCT Article 33(2)

The present application meets the requirements of Article 33(2) PCT because none of the cited documents alone discloses the subject matter of present application.

Inventive step under PCT Article 33(3)

The subject matter of claims 1-29 of present application does not meet the requirements of Article 33(3) PCT in view of cited documents D1-D2.

Regarding claims 1,3-10,12-13,15-22, 25, 27 and 28:

D1 discloses a fertilizer composition comprising elemental sulphur and clay matrix (which acts as suspending aid) and additional micronutrient fertilizer (such as manganese oxide, water insoluble manganese salt) material dispersed into said matrix (claims 1,2,6). The sulfur to clay ratio of about 10 to 1 to about 20 to 1 by weight (claim 17). The average particle size is less than about 150 microns (claim 15).

D1, however, does not disclose excipients such as pH adjusters, rheology modifiers etc. D2 discloses liquid micronutrient fertilizer composition comprising an aqueous dispersion of soluble and insoluble micronutrients (claim 1). The insoluble micronutrient comprises

elemental sulfur, 1-80 wt.% (claims 3,5). The soluble micronutrient comprises manganese nitrate, manganese chloride, manganese bromide, manganese iodide, manganese sulfate, manganese oxysulfate, manganese acetate, manganese citrate, 0.5-25 wt.% (claims 2,4). The composition also comprises of excipients such as pH adjusters, rheology modifiers (paras [0009-0012]). By combining the fertilizer composition as disclosed in D1 with the excipients as disclosed in D2, a person skilled in the art can arrive at the subject matter of claims 1,3-10,12-13,15-22 and 28.

Moreover, D1 discloses a process for the preparation of a controlled release fertilizer particle comprising preparing a liquefied mixture of sulfur and clay; blending an additional fertilizer material into said liquefied mixture; transferring said liquefied mixture to a granulator (which acts as miller); and collecting said granules of a predetermined size (claim 8).

D2 discloses a method to increase rheology for fertilizer suspensions is through the addition of clays, primarily bentonite. These clays are used up to a 10% loading to increase the rheology (para [0003]). By combining the process as disclosed in D1, along with the rheology adjustments as disclosed in D2, a person skilled in the art can arrive at the subject matter of claims 25 and 27.

Regarding claims 2,10-11,14 23-24 and 26 :

D1 discloses a fertilizer composition comprising elemental sulfur and clay matrix (which acts as suspending aid) and additional micronutrient fertilizer (such as manganese oxide, water insoluble manganese salt) material dispersed into said matrix (claims 1,2,6). The sulfur to clay ratio of about 10 to 1 to about 20 to 1 by

weight (claim 17). The average particle size is less than about 150 microns (claim 15).

D1, however, does not disclose excipients such as pH adjusters, rheology modifiers etc. D2 discloses liquid micronutrient fertilizer composition comprising an aqueous dispersion of soluble and insoluble micronutrients (claim 1). The insoluble micronutrient comprises elemental sulfur, 1-80 wt.% (claims 3,5). The soluble micronutrient comprises manganese nitrate, manganese chloride, manganese bromide, manganese iodide, manganese sulfate, manganese oxysulfate, manganese acetate, manganese citrate, 0.5-25 wt.% (claims 2,4). The composition also comprises of excipients such as pH adjusters, rheology modifiers and dispersion aids such as poly electrolytes (see paras [0009-0012]).

By combining the fertilizer composition as disclosed in D1 with the excipients and dispersion aids as disclosed in D2, a person skilled in the art can arrive at the subject matter of claims 2,10-11,14 and 23-24.

Regarding claim 26, D1 discloses a process for the preparation of a controlled release fertilizer particle comprising preparing a liquefied mixture of sulfur and clay; blending an additional fertilizer material into said liquefied mixture; transferring said liquefied mixture to a granulator (which acts as miller); and collecting said granules of a predetermined size (claim 8). D2 discloses a method to increase stability and rheology for fertilizer suspensions is through the addition of clays, primarily bentonite. These clays are used up to a 10% loading to increase the rheology (para [0003]).

By combining the process as disclosed in D1 along with the rheology adjustments as disclosed in D2, a person skilled in the art can arrive at the subject matter of claim 26.

Regarding claim 29

D1 discloses a a fertilizer composition comprising elemental sulfur and clay matrix (which acts as suspending aid) and additional micronutrient fertilizer.

D2 discloses liquid micronutrient fertilizer composition comprising an aqueous dispersion of soluble and insoluble micronutrients (claim 1).

Thus, by combining the use as fertilizer composition (liquid suspension) as disclosed in D1 and use as fertilizer composition (aqueous dispersion) as disclosed in D2, a person skilled in the art can arrive at the subject matter of claim 29.

Thus, claims 1-29 lack an inventive step in view of D1-D2.

Industrial Applicability Under PCT Article 33(4)

Claims 1-29 meet the criteria set out in Article 33(4) PCT, and thus have industrial applicability because the subject matter claimed can be made or used in the industry.

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Message:

Dear Sir,

Re: VADAKEKUTTU, THANKAPAN; SAWANT, ARUN VITTHAL

PCT International Application No.: PCT/IN2018/053881

Filed on: May 10, 2019

Priority Date: May 10, 2018

RESPONSE TO IPER

We enclose herewith, a response to the international preliminary examination report with mailing date of Feb 3, 2020. The response pertains to addressing the objections on inventive step and claim conciseness, raised for the present application.

It is respectfully submitted that the response submitted herewith establishes the inventive step in the present invention. The applicant respectfully submits amended set of claims 1-29 and the Ld Examiner is requested to consider the same on record.

It is requested that the enclosed response is duly considered and taken on record by your esteemed office.

Yours sincerely,

Dipak Mundra

[Agent for Applicants]

IN/PA-613

Enclosures:

Response to IPER

Amended claims- Marked up and clean copy

Annexure A

The following documents have been uploaded via ePCT:

- Formal response to the Written Opinion of the IPEA

✓
Signature: /Dipak Mundra/
Signatory: MUNDRA, Dipak (Agent)
Date: 03 March 2020 20:32:05 IST
User name: DIPAK MUNDRA
Authentication: Sign-in with strong authentication

PCT/1B/2013/053881

Agent's Ref.: PCT-2018-034 March 3, 2020

Kind Attn: Harshita Chadda (Authorized Officer)

Indian Patent Office

Plot No. 32, Sector 14, Dwarka, New Delhi-110075, India

Telephone No. +91-1125300200

Dear Sir,

Re: VADAKEKUTTU, THANKAPAN; SAWANT, ARUN VITTHAL

PCT International Application No.: PCT/IN2018/053881

Filed on: May 10, 2019

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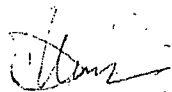
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It is respectfully submitted that the response submitted herewith establishes the inventive step in the present invention. The applicant respectfully submits amended set of claims 1-29 and the Ld Examiner is requested to consider the same on record.

It is requested that the enclosed response is duly considered and taken on record by your esteemed office.

Yours sincerely,



Dipak Mundra
[Agent for Applicants]
IN/PA-613

Enclosures:

Response to IPER

Amended claims- Marked up and clean copy

Annexure A

Agent's Ref.: PCT-2018-034

Kind Attn: Harshita Chadda (Authorized Officer)

Indian Patent Office

Plot No. 32, Sector 14, Dwarka, New Delhi-110075, India

Telephone No. +91-1125300200

Dear Sir,

Re: VADAKEKUTTU, THANKAPAN; SAWANT, ARUN
VITTHAL

PCT International Application No.: PCT/IN2018/053881

Filed on: May 10, 2019

Priority Date: May 10, 2018

Sub: Reply to the International Preliminary Examination Report

This is in reference to the International Preliminary Examination Report dated February 3, 2020 for this application. We submit herewith our response to the same.

We have the honor to submit herewith claim amendments (marked up copy and clean copy) which are as follows:

- Claims 25, 26 are amended to make it dependent on claims 1 and 2 respectively in order to be more concise, precise and meet the requirements of article 6 of PCT.

At the outset, the applicants are grateful to the Ld. Examiner for acknowledging the novelty and the industrial applicability of all the pending claims on this application. Please find below our reply to the other objections raised in the International Preliminary Examination Report.

1. OBJECTION ON INVENTIVE STEP:

The Ld. Examiner has raised objection that claims 1-29 do not meet the requirements of PCT article 33 (3) in view of the following prior art documents:

D1: US6749659 B1

D2: US2017283334 A1

The Applicant respectfully resists the objection and presents the following submissions in this regard:

The present invention relates to a liquid suspension composition for crop nutrition comprising: elemental sulphur in the range of from 1%-60% by weight; at least one manganese salt, its complexes, derivatives or mixtures thereof in a concentration in the range of from 0.1%-55% by weight; at least one excipient; and at least one structuring agent in the range of 0.01 %-5% by weight with the particle size in the range of 0.1 to 20 microns. The present invention also relates to a water dispersible granular composition for crop nutrition and fortification composition, wherein the composition comprises: elemental sulphur in the range of from 1%-90% by weight; at least one manganese salt, its complexes, derivatives or mixtures thereof in the range of from 0.1%-70% by weight; and at least one dispersing agent in the range of from 1% - 30% w/w where the granules are in the range of from 0.1-2.5 mm and comprise particles in the size range of from 0.1 micron to 20 microns.

The Applicant humbly submits that none of the cited prior art even remotely disclose, suggest or teach the claimed composition as discussed above comprising elemental sulphur in a specific concentration; at least one manganese salt, its complexes, derivatives or mixtures thereof in a specific concentration; excipients; and wherein the compositions comprise particles in the size range of 0.1 micron to 20 microns, as claimed.

It is further submitted that the claimed composition is distinct from those disclosed in any of the cited references, not only in terms of its novel structural embodiments, but also the effect exhibited on account of the same. It has been surprisingly found that the claimed composition in the form of water dispersible granules and liquid suspension, both of which include particles in the size range of 0.1 micron to 20 microns, provides excellent results in terms of yield, plant growth, vitality, vigor and crop protection, demonstrate superior performance under accelerated storage and is effectively used in drip irrigation. Moreover, the composition exhibited surprisingly higher field efficacy at reduced dosages of application of the composition.

The Applicant submits that for an obviousness analysis the prior art references must be considered in its entirety and it needs to be verified whether these references either taken singly or together as a whole, teach, suggest or motivate a skilled person on the date of filing of the invention, to arrive at the claimed composition with a reasonable expectation of success.

It is submitted that the prior arts cited in the examination report either taken alone or in combination are not at all relevant and do not disclose, teach or suggest the composition claimed composition nor do they provide any motivation or any expectation of success for arriving at the claimed composition. A person skilled in the art cannot arrive at the claimed invention by arbitrarily picking and choosing elements from isolated prior arts without any teaching, suggestion and motivation derived there from and without any reasonable expectation of success.

Comments on cited prior arts:

1. US6749659 B1 (D1) :

With respect to D1, the Examiner states that D1 discloses a fertilizer composition of sulphur and clay matrix and an additional fertilizer dispersed in said matrix, whereby the sulphur to clay ratio is about 10 to 1 to about 20 to 1 by weight and that the average particle size is less than about 150 microns.

The Applicant submits that the objective of D1 is to provide a controlled release formulation in the form of pastilles, which is achieved by the mandatory inclusion of a swelling clay material. D1 specifically includes about 10% clay and about 10% ammonium sulfate fines in the balance of liquid molten sulfur. D1 emphasizes that the rate of release of the additional fertilizers is subject to the controlled release mechanism, attributed to the presence of swelling clay in the composition leading to better distribution in the soil. Thus, the pellet composition of D1 essentially includes swelling clay in combination with sulphur, ammonium fines and fertilizer which results in controlled release and prevents the washing of the soluble fertilizer due to heavy rainfall. By doing so, the release of the ammonium sulfate component is slowed down while the release of the elemental sulfur component is simultaneously accelerated by the use of swelling clays.

D1 states that the particle size of the ammonium sulphate fines is less than 300 microns, preferably less than 150 microns which aids to achieve significant loadings in the sulfur-bentonitic clay formulation, without the risk of separation of the suspended solids in the manufacturing process, such as granulating or pastillation processes. It further states that the clay particle size is not greater than 200 mesh (74 microns) in order to ensure a stable suspension of the clay in the liquid sulfur during the process time prior to solidification. Thus D1 is directed to a pastille composition wherein the pastilles when in contact with moisture disintegrate to larger particles. The composition of D1 nowhere remotely close to the claimed composition which is in the form of water dispersible granules or suspension concentrates with particle size as low as 0.1 to 20 microns.

At the cost of reiteration, it is important to note that pastilles disclosed in D1 are structurally distinct formulation vis-à-vis a water dispersible granular composition or a

suspension concentrate composition on account of the fact that it essentially includes swelling clay which on coming in contact with water swells and disintegrate into larger crystals or particles.

For clarity and better understanding of the distinction between the prior art and the claimed composition the applicant have the honor to submit herewith Annexure A. The data presented in figure 1A and figure 2A of Annexure A clearly indicates the physical distinction between the water dispersible granules of the present invention and the pastilles similar to those disclosed in D1. The Applicant submits that it is quite natural that the owing to their large size, the pastilles exhibit nozzle clogging in spray applications, thereby posing a problem in delivery of nutrients to the plant or the crop which affects the overall quality and yield of the crop. Moreover, pellets, pastilles, etc. owing to their larger particle size distribution, exhibits poorer suspensibility, uneven distribution in the soil and uneven coverage on the crop. Such pellets or pastilles lead to irregular release of the micronutrients or get accumulated in the soil surface, resulting in poorer field efficacy in crops.

The Applicant submits that Figure 2B as presented in Annexure A clearly indicates the settling behavior of the pellet composition as disclosed in D1 when compared to the composition of the present invention. It was observed that the pellets of D1 on account of their physical property tend to disintegrate into larger particles and settle or sediment at the bottom of the cylinder, leaving behind a significant residue which results in non-uniform suspension and therefore non-uniform distribution or coverage of the actives on the crops, resulting in poor uptake of the nutrients by the crop, thus hampering the crop quality. On the other hand, as can be seen from Figure 1B and 1D, the compositions of the present invention in the form of water dispersible granules and suspension concentrate, respectively, remain suspended easily and uniformly preventing sedimentation of the actives at the bottom of the cylinder thereby ensuring uniform

distribution of the actives to the crops resulting in better nutrient uptake and quality of the crops.

It is relevant to note that on account of the physical property, pastille compositions as disclosed in D1, they are only suitable for broadcast applications, owing to their disadvantages such as poor dispersion and suspensibility in water, which is clearly evident from the figure 2B presented in Annexure A. Water dispersible granular composition and liquid suspension composition on the other hand comprises of fine particles of size 0.1 to 20microns which is readily dispersible and available for quick uptake by plants. This is clearly evident from the data presented in Figure 1B and 1D of Annexure A. Such fine sized formulations as claimed in the present application, disperse well in water and are suitable for use in drip irrigation.

Without prejudice to the aforesaid, it is further submitted that reference in D1 to the inclusion of manganese is purely optional where manganese is disclosed one amongst the many in the list of several other additional fertilizer components that may be included in the composition of D1. There is no specific disclosure or motivation for a person skilled in the art, based on D1 which relates to a pellet composition, to selectively pick manganese and combine it with sulphur and arrive at a water dispersible granule or suspension concentrate, let alone any disclosure for the concentration of these actives in the forms and at the specific particle size as claimed in the present application.

Therefore, it is evident that both the structure and objective of D1 vis-à-vis the present invention is at a complete variance to each other, wherein D1 teaches preparing a pastille formulation which is a very slow release formulation comprising sulphur, and swelling clay with additional fertilizers (ammonium sulphate) whereas the present invention seeks to obtain a water dispersible granular formulation or a liquid suspension composition comprising elemental sulphur and atleast one manganese salts, their complexes or

derivatives or mixtures thereof where the composition is readily dispersible providing quick availability of nutrients to the plants.

It is submitted that the composition of D1 and the present invention are non-comparable also on the basis of the results they cater to, i.e D1 catering to slow release of the actives, whereas the claimed composition is meant for instant delivery of the claimed actives so as to facilitate rapid uptake by the plants.

The above submissions sufficiently establish that D1 teaches away from the present invention and is a completely non-analogous reference to establish non-inventiveness of the claimed composition.

With respect to the Examiners observation that use of sulphur and manganese is a common practice in the art and therefore on this account the claimed invention is obvious. The Applicant humbly states that the invention does seek to claim a mere combination of sulphur and manganese or any commercially available formulation comprising of sulphur and manganese. It needs to be appreciated that the inventors herein have invented novel and effective composition of sulphur and manganese in the form of water dispersible granules or suspension concentrate in specific concentration and particle size range which has not been taught, disclosed or suggested by any of the art.

Furthermore, the Applicant has clearly indicated in the data presented in table 2, page 60 of the specification that the claimed composition in the form of water dispersible granules or liquid suspension, overcomes the drawbacks associated with the pastille composition. For instance, it was noted that treatment T1 [Sulphur 80% + Manganese 7.74% (manganese oxide 10%) water dispersible granules as per the present invention] has total soluble carbohydrate content of 9.12mg/g dry weight, grain yield of 1344.2 kg/acre when compared to treatment T4 (Sulphur 80% + Manganese 7.74% pastilles) with total soluble carbohydrate content of 6.82 mg/g dry weight, grain yield of 1187.2 kg/acre when tested on soyabean. The yield increase with treatment T1 as compared to control was about

27.66% whereas yield increase with treatment T4 was only 12.7%. Treatments T1, T2, T3, T7, T8, and T9 with compositions as per the claimed invention, showed a significantly higher grain yield of soybean, carbohydrate content and an increased oil content as compared to treatments T4, T5 and T6 with pastille compositions as disclosed in D1. Thus, the claimed compositions exhibits superior efficacy, in terms of crop characteristics and yield as compared to the composition in form of pastilles.

Therefore to summarize, the applicant reiterates that D1 essentially teaches a skilled person to prepare a pellet composition with molten sulphur, swelling clay and an additional fertilizer and leads one away from formulating the claimed composition which is in the form of an aqueous suspension or water dispersible granular composition, comprising sulphur in specific concentration and manganese or its salts or derivatives in specific concentration where the composition includes particles in size range as low as 0.1 to 20 microns.

In addition to the aforementioned submission, it is important to note that not only the form of the composition but also the particle size of the present invention is different from that of D1. The fact that the inventive aspect of the claimed composition lies in it being in a water dispersible granular or and liquid suspension form and with specific particle size range is also evident from the comparative results exhibited in the data provided in the specification. A person of skill in the art on reading D1, will only be motivated to prepare controlled release granules in the form of pastilles with diametrically opposite characteristics than the composition of the present invention and therefore D1 cannot be considered relevant for the lack of inventiveness of the claimed composition.

Accordingly, the Ld Examiner is requested to withdraw the objection in this regard to kindly consider, the objection of obviousness in view of D1.

2. US2017283334 A1 (D2):

The Examiner has noted that the claimed invention is lacking in inventive step over D2. In this regard the Examiner states that though D2 mentions that the liquid micronutrient fertilizer composition is in the form of a paste but can be adjusted to form an aqueous suspension by addition to water. The Examiner further reasons that this means that the composition disclosed in D2 is a water dispersible granular composition.

It is submitted that D2 discloses a liquid micronutrient fertilizer composition comprising an aqueous dispersion of soluble and insoluble micronutrients mixed essentially with a polyelectrolyte and a metal complexing agent, where the actives are released in an immediate and sustained manner. It is submitted that sulphur and manganese are one amongst the many nutrients disclosed in a laundry list of D2 and a skilled person may encompass more than 200 likely permutations and combinations of micronutrients based on D2. There is no teaching, suggestion or motivation to single out a combination of sulphur and one or more manganese salt or derivative, as claimed, from such a huge list of combinations that can be derived from D2.

Having said that it is submitted that, the Ld Examiner has failed to note the fact that the composition of D2 is in the form of thick paste which is structurally and physically very different than those of water dispersible granules or liquid suspension composition as claimed in the pending application.

To enunciate the structural and physical distinction of the claimed composition vis-à-vis that disclosed in D2, the applicant has the honor to submit herewith Annexure A. The composition claimed in the present invention i.e water dispersible granules or liquid suspensions and thick paste of D2 are being structurally and physically different is clearly evident from the figures 1A, 1C and figure 3A of Annexure A. It may be noted that the water dispersible granules is a solid formulation which is easily wettable and disperses quickly into fine particle suspension when added to water whereas paste composition of D2 is a semisolid non-dispersible formulation which tends to float or stick to the surface when added to water. This is clearly evident from the data submitted in the figure 3A of

Annexure A which clearly depicts that the composition as claimed in D2 forms a thick paste. On the other hand, the compositions of the claimed invention as seen in figure 1A (water dispersible granules) and figure 1B (liquid suspensions) are free flowing formulations which are easily dispersible and suspendible. Thus, from the aforesaid it is clearly evident that the composition of the claimed invention is structurally and physically different from D2, consequently leading to an effective mode of administration and application to crops against the composition of D2.

Without prejudice, it is submitted that there is no disclosure or teaching in D2 for the combination of sulphur and manganese or its salts or derivatives in the form of water dispersible granules and liquid suspension designed for ready dispersion and rapid or instant availability of both the actives namely sulphur and manganese or their salts or derivatives to the crops. In addition to the aforesaid, the distinction between D2 and the present invention is also evident from the examples of D2 which disclose the composition to be prepared in the form of a gel or paste formulations of soluble and insoluble nutrients. Furthermore, the composition of D2 floats on the top of cylinder on addition to water, which is clearly visible from data presented in figure 3B of Annexure A. The paste or gel of the D2 composition on addition to water does not disperse uniformly but tends to either float at the top or settle at the bottom of the measuring cylinder retarding the release of actives. Even after allowing the samples to stand for about 24 hours, it is observed from figure 3C that the paste of the D2 composition starts to release actives in a non-uniform pattern as compared to the composition of the claimed invention. The thick paste of D2, even after 24 hours is observed to float at the top of the cylinder is clearly indicative of non-uniform distribution of actives in solution. Thus, the composition of D2 can never be an effective mode of administration of actives to crops thus hampering the availability of nutrients to the crops and eventually resulting in poor crop growth and yield.

In addition to the clear structural and physical distinctiveness of the composition disclosed in D2 as that of the claimed invention, the applicant reiterates that the objective of D2 is also at complete variance with the claimed invention. It is important to note that

the composition of D2 seeks to provide a dual delivery system for both immediate and sustained release of micronutrients. In this regard, the Ld Examiners attention is invited to Page 6, Paragraph 16 of D2 which states that the soluble micronutrient present in its composition will be readily available to a plant, correcting any micronutrient deficiency, while the insoluble micronutrient will gradually convert to a soluble form over time. On the other hand, the claimed composition provides for instant availability of sulphur and manganese to the crops, minimizing the loss of actives, makes the actives instantly available for uptake which strengthens the crop, improving crop characteristics and subsequently yield. The immediate dispersion of actives of the claimed composition is clearly evident from the data presented in figures 1B and 1C of Annexure A. The uniformly dispersed solution clearly indicates that the claimed composition provides for uniform application of the actives for ready uptake by the plants whereas the composition of D2 on addition to water floats at the top of cylinder as observed from figure 3B and figure 3C of Annexure A which retards the releases of actives to the crops for longer period of time.

With regard to the Ld Examiners observation on particle size of D2 whereby the examiner states that the particle size mentioned in D2 is less than that of the present application resulting in better crop yield, the Applicant would like to draw the attention of the examiner to the fact that D2 specifically talks about the particle size of the active per se i.e insoluble micronutrient particle whereas the claimed invention specifies particle size of the entire composition. D2 nowhere teaches that the particle size of the entire composition is in the range of 0.1 micron to 20 microns, as claimed in the present application, but only talks about the particle size of the insoluble micronutrient.

The Examiner may kindly appreciate that the Applicant has already discussed in the background section the drawbacks exhibited by compositions, as disclosed in D2, which emphasizes on milling or crushing of only the insoluble micronutrients, so as to form a fine powder or dust. The Applicant states that milling of only insoluble micronutrients and mixing other fertilizers, micronutrients and excipients later would lead to a non-

uniform blend of actives in the formulation which may not be desirable in terms of its application and also lead to poor uptake of the nutrients by the plants.

The Applicant humbly states that the data presented in Table 6 of the specification clearly indicates that the combination of sulphur and manganese salts in the form of water dispersible granules prepared as per embodiment of the claimed invention with particle size of 0.1 to 20 microns substantially improves grain yield of soyabean as compared to the composition with broader particle size. For instance, treatment T1 (Sulphur 40% + Manganese dioxide 25% WDG with particle size of 0.1 to 20 microns as per embodiment of the claimed invention) demonstrated 33% yield increase as compared to control whereas treatment T4 (Sulphur 40% + Manganese dioxide 25% WDG with particle size of 20 to 50 microns) has yield increase of only 19.8%. This clearly indicated that the composition in the form of WDG or SC with particles only in the size range of 0.1 to 20 microns demonstrate good yield as compared to the same composition with a higher particle size range. Thus, claimed compositions of Sulphur and manganese in the size range of 0.1 to 20 microns leads to uniform blend of actives in the formulation which is desirable in terms of uptake of the nutrients by the plants and hence the yield of crops or plants.

Thus given the fact that D2 pertains to an entirely different formulation both structurally and functionally, whereby the examples of D2 relate to paste or gel based compositions, it is submitted that D2 does not provide any motivation to arrive at the combination of sulphur and manganese salt or derivative in the forms as claimed, that too in specific concentration ranges and particle size range as claimed.

In view of the above submissions, the Applicant states that a person skilled in the art would never consider D1 which is a non-analogous reference relating to an entirely different composition in the form of pastilles and combine it with the composition of D2 which is admittedly forming a thick paste to arrive at the claimed composition which is a water dispersible granule or a suspension concentrate with a specific concentration of

actives wherein the composition is present at a specific particle size. It is submitted that the composition of the present application is a superior and enhanced composition comprising of a combination of specific actives or nutritional elements which is stable and produces surprising and enhanced results at reduced dosages as compared to commercially available products. Thus, the composition claimed in the present invention is distinct from the composition of the cited references not only in terms of its novel structural embodiments i.e. aqueous suspension composition or water dispersible granular composition comprising elemental sulphur, at least one manganese salt, its complexes, derivatives or mixtures thereof and at least one structuring agent or dispersing agent in a specific concentration and having specific particle size, but also in terms of superior physical characteristics such as suspensibility, dispersibility, flowability, wettability and improved viscosity resulting in better pourability and storage stability thereby providing an ease in application of the composition in the field resulting in superior field efficacy in terms of yield, plant growth, vitality and vigor at significantly reduced dosages of the composition. This has also been demonstrated in the specification through extensive experimentation and field trial demonstrating significant improvement in crop fortification, nutrition and protection.

The applicant respectfully submits that to establish obviousness "there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to a person skilled in the art, to modify the reference or to combine the reference teachings in order to arrive at the claimed subject matter". Also on reading the prior art documents, a person of skill in the art must believe that there exists a reasonable expectation of success to arrive at the claimed invention.

It is submitted that one cannot cite lack of inventive step by merely identifying one or two common features from prior arts and extrapolating it to argue obviousness by ignoring the overall teachings of these references. Such an analysis is regarded as based on hindsight reasoning and is not permitted under the law.

It is humbly submitted that the present examination report has completely ignored the overall teaching of D1 which pertains to pastille compositions to facilitate the slow release of the active ingredients which disintegrate into large particles due to presence of swelling clay in the composition or that of D2 leads to thick paste and provides for both the immediate release of the soluble micronutrients and delayed release of the insoluble nutrients, and has only identified one common characteristic of this reference ie the presence of sulphur and manganese. It is submitted that the overall teachings of the cited references that a person skilled in the art would decipher on reading D1 & D2 are completely opposed to the claimed composition of the present invention which is designed for a water dispersible granule or suspension concentrate composition providing ready availability of the actives to the crops or the plants.

It is submitted that the cited prior arts do not attempt to solve the problem, the present invention does, and hence, a person of ordinary skill, reading these references, will never be motivated to arrive at the present invention in view of the divergent teachings of the cited references.

Without prejudice to the aforesaid submission which clearly distinguishes the claimed invention over the cited references, the applicant would like to bring the attention of the Ld Examiner to the surprising results observed with the composition of the claimed invention:.

It is submitted that the claimed composition exhibits surprising and unexpected results at reduced dosages as can be seen from the data already presented in the specification. The data clearly demonstrates the surprising benefit of delivery of the claimed combination in the form of water dispersible granules, liquid suspension over pastilles. The Applicant further states that the efficacy of the claimed invention is attributed not only due to the

composition but also the form of delivery of the composition with specific particle size range of composition of about 0.1 to 20 microns.

For instance it can be seen from Figure 1 and the calculations made, that the expected carbohydrate content in the soybean leaves was 35.3 mg/gm. On application of treatment T4 and treatment T6 with compositions as per the embodiments of the present invention, a 80.1% and 74.55% increase in the carbohydrate content over the untreated control was observed whereas Treatment T5 with sulphur plus manganese dioxide pastille composition (similar to the one disclosed in D1) with same amount of sulphur and manganese being applied, only showed an increase of 21.88% in the carbohydrate content, over the untreated control. The compositions of treatments T4 and T6, as per the present invention, as also indicated in the graph, thus exhibited a synergistic effect compared to the pastille composition of treatment T5.

It may be further noted that the data adduced along with the specification on Pages 59-81 using the claimed combination highlights significant improvement in several crop parameters such as the grain yield, soluble carbohydrate content, grain weight, oil content, number of effective tillers, tuber yield, number of pods per plant in plants such as soybean, wheat and potato. The data also highlights the improved physiological characteristics of the plant such as greenness, fruit weight, plant height and nutritional value of the crop with the application of the claimed composition.

Furthermore, Table 1 on Page 59 of the specification shows that treatment T4 with water dispersible granules, and the treatment T6 suspension-concentrate composition, both as per the embodiment of the present invention showed a 32.8% and 31.5% increase in the soybean grain yield, as compared to the untreated control. Further, compositions of treatment T4 and Treatment T6 both as per the embodiment of the present invention, showed a surprising 10.47% and 9.4% increase, respectively in the grain yield of soybean, as compared to the treatment T5 with sulphur and manganese dioxide (Mn -15.9%)

pastille composition (similar to the composition disclosed in D1). Thus compositions as per the embodiment of the present invention, demonstrated a synergistic behavior.

Further Table 3 of the specification shows that treatments T4 and T6 with water dispersible granules and suspension concentrate, respectively, both as per the present invention showed a synergistic effect and a surprising enhancement in the grain yield of wheat of 32.5% and 31.6% respectively, as compared to the treatment T5 with sulphur and manganese oxide pastilles, which only showed a 21.1% increase over the untreated control, when the compositions in each of the above treatments had the same dose of sulphur and manganese being applied.

It is seen from table 4 of the specification that Treatments T1, T2 and T3 with sulphur and manganese in water dispersible granular forms, as per the present invention, showed a 22.2%, 25.9% and 19.0% increase in the yield of wheat plant as compared to the untreated plants, whereas the Treatments T7, T8 and T9 with sulphur and manganese in liquid suspension form, as per the present invention showed 19.7%, 22.8% and 22% increase, respectively, in the grain yield of wheat, compared to the untreated control. On the other hand, it was observed that treatments with varying concentrations of Sulphur plus manganese in the pastille form (Treatments T6, T7 and T8), known in the art, showed only a 6%, 11.2% and 8.4% increase, respectively, in the grain yield of wheat, compared to the untreated control.

Table 5 shows that Treatments 4 and Treatment 6 with compositions as per the present invention, showed a 59.1% and 60.1% reduction, respectively, in the disease incidence, as compared to the untreated control or and these treatments are also far superior to Treatment 5 with Sulphur and manganese dioxide (Mn -19.19%) pastilles, similar to the composition disclosed in D1 or as compared to Treatments T2 and T3 with individual actives. Also the treatments with compositions as per the embodiment of the invention, exhibited a significant enhancement in the yield of the potato tubers, as compared to all other treatments.

Table 7 of the specification further substantiates the efficacy of the claimed compositions by showing a significant yield increase in the potato tubers.

In addition to the aforementioned submission, it is important to note that not only the form of the composition but also the particle size of the present invention is different from the composition of D1. The fact that the inventive aspect of the invention resides in the claimed formulations which are in the form of water dispersible granules and liquid suspension and particle size range is also evident from the comparative results exhibited under Table 6 of the specification.

Table 6 clearly demonstrates the impact of the different range of particle size of composition of 40% Sulphur + 25% Manganese dioxide on the yield of soybean. It can be seen that Treatment T2 (with water dispersible granular composition having particles in the size range of 0.1 micron to 20 microns) as per the embodiment of the present invention showed a significant increase in the yield of 33.2% as compared to treatments T3 (water dispersible granules having particle size in the range of 0.1 to 50 microns), T4 (granules with particle size in the range of 20 to 50 microns) and T5 (granules with particle size in the range of 50 to 100 microns), which showed a yield increase of 21.3%, 19.8% and 11.4% respectively, over the untreated control. This shows superior efficacy with the water dispersible granular formulation, as per the present invention with composition having particles in the size range of 0.1 micron-20 microns, as compared to water dispersible granular formulations with higher particle size ranges.

Thus, the combination of sulphur and various manganese salts at different concentrations in the form of water dispersible granules and suspension concentrates, as per the embodiments of the present invention, with specific particle size range demonstrated a significant enhancement in the yield, as well as the soluble carbohydrate content, and oil content in soybean, as compared to the treatments with sulphur and manganese salts in

pastille form, particularly when sulphur and manganese are applied at the same dosages of application.

In view of the above submissions and surprising results, it is humbly submitted that the teachings recited in prior art D1 and D2, nowhere hint a skilled person to arrive at the specific composition as claimed in the pending application nor does it provide any expectation of success to arrive at an efficacious composition as claimed wherein the composition has particle size in the range of 0.1 to 20 microns, which provide a surprisingly enhanced yield and disease control as compared to known pellet or pastille compositions.

The Applicant would like to put forth that the claimed composition is novel, inventive and efficacious on account of a combination of structural features such as the composition being in a water dispersible form or in the form of liquid suspension with specific actives namely sulphur and manganese salts or derivatives in a specific concentration, wherein the compositions particularly include particles in a specific size range. As stated above, the unique structural features of the composition impart an instantaneous availability of the actives to the plant eventually resulting in higher nutrition, yield and crop protection.

Thus based on the aforementioned submissions, it is evident that none of D1 or D2, singly or considered together in combination are even remotely pertinent to the particular problem that the inventors of the present invention are trying to solve at the time of invention was made i.e. preparing a water dispersible granular composition or the liquid suspension composition, with enhanced suspensibility, dispersibility wherein the actives are made available instantaneously to the crops resulting in enhanced efficacy.

Furthermore, since Claim 1 and 2 are inventive, the dependent claims 3 to 29 are also mutatis mutandis inventive over the cited prior art references considered singly or in combination.

The Learned Examiner is therefore requested to consider the above submissions and withdraw the objection raised on lack of inventive step with respect to amended claims 1-29 over the teachings of D1 and D2.

Clarity and Conciseness (Box No. VII):

With regards to the objection that the claims 25 and 26 appear to relate effectively to same subject matter as that of claim 1 and 2 and lacks conciseness in sense of the Article 6 of PCT, the Applicant has suitably amended the claims 25 and 26 to make them dependent on claim 1 and claim 2, respectively. It is further submitted that these amendments in a reasonable way relate to specific components claimed in claim 1 or claim 2 and also impart clarity and conciseness to the claimed invention.

The Ld. Examiner is respectfully requested to take the above submissions on record and withdraw the objection raised in the International Preliminary Search Report with regards to Lack of Conciseness and Lack of Inventive Step in view of the cited prior art references.

Yours sincerely,



Dipak Mundra

[Agent for Applicants]

IN/PA-613

Encl:

1. Marked up copy of amended claims
2. Clean copy of amended claims
3. Annexure A

I Claim,

1. A liquid suspension composition for crop nutrition and fortification, wherein the liquid composition comprises:

elemental sulphur in the range of from 1%-60% by weight of the total composition;

at least one manganese salt, its complexes, derivatives or mixtures thereof in the concentration in the range of from 0.1%-55% by weight of the total composition;

at least one agrochemically acceptable excipient; and

at least one structuring agent in the range of 0.01 %-5% by weight of the total composition; and,

wherein the composition comprises particles in the size range of from 0.1 micron to 20 microns.

2. A water dispersible granular composition for crop nutrition and fortification composition, wherein the composition comprises:

elemental sulphur in the range of from 1%-90% by weight of the total composition;

at least one manganese salt, its complexes, derivatives or mixtures thereof in the range of from 0.1%-70% by weight of the total composition; and,

at least one dispersing agent in the range of from 1% - 30% w/w of the total composition; and,

wherein the granules of the composition are in the range of from 0.1-2.5 mm and comprise particles in the size range of from 0.1 micron to 20 microns.

3. The composition as claimed in the claims 1 or 2, wherein the manganese salts comprise at least one water soluble salt and water insoluble salts or complexes or derivatives or mixtures thereof.

4. The composition as claimed in claims 1 or 2, wherein the manganese salts comprise at least one water insoluble manganese salts or complexes or derivatives or mixtures thereof.

5. The composition as claimed in claims 1 or 2, wherein the water insoluble manganese salts comprise at least one of manganese oxide; manganese(II) oxide, MnO (Ferrite Grade); Manganese(II,III) oxide, Mn₃O₄; Manganese(III) oxide, Mn₂O₃; Manganese(VI) oxide, MnO₃; Manganese(VII) oxide, Mn₂O₇; trimanganesetetroxide or manganic oxide or hausmannite; manganese hydroxide; manganese dihydroxide; manganous hydroxide; rhodochrosite; manganese phosphate; manganese phosphate heptahydrate; manganese (II) phosphate; manganese diphosphate; manganese phosphate tribasic; carbonyl manganese; manganese dioxide; manganese dioxide, (manganese(IV) oxide), MnO₂; manganese diselenide; manganese tetroxide; manganese carbonate; manganese molybdate; manganese selenide; manganese telluride; manganese titanate; manganese nitride; manganese oxalate; manganese ferrocyanide; manganese fluoride; manganese borate; manganese sulphide; dimanganese trioxide; manganese peroxide; manganese ferrocyanide; Manganese sulphide; manganese binoxide; manganese black; pyrolusite; manganese superoxide and complexes, derivatives or mixtures thereof.

6. The composition as claimed in claims 1 or 2, wherein the water insoluble manganese salts comprises at least one of manganese oxide; manganese(II) oxide, MnO (Ferrite Grade); Manganese(II,III) oxide, Mn₃O₄; Manganese(III) oxide, Mn₂O₃; Manganese(VI) oxide, MnO₃; Manganese(VII) oxide, Mn₂O₇; manganese hydroxide; manganese phosphate; manganese dioxide; manganese carbonate; manganese oxalate; manganese borate and complexes, derivatives or mixtures thereof.

7. The composition as claimed in claims 1 or 2, wherein the manganese salts comprise at least one water soluble manganese salts or complexes or derivatives or mixtures thereof.

8. The composition as claimed in claims 1 or 2, wherein the water soluble manganese salts comprise at least one of dimanganese trioxide, manganese acetate, manganese diacetate, manganese gluconate, manganese bromide, manganese chloride, manganese iodide, manganese succinate, manganese fumarate, manganese nitrate, manganese dichloride, sodium manganate, potassium permanganate, manganese citrate, manganese bicarbonate, manganese dichromate, manganese fluorosilicate, manganese ammonium phosphate; Manganese zinc ferrite, Manganese chlorate tetrahydrate, manganese bromide, sodium manganate, manganese sulphate, , manganese chelate and complexes, derivatives or mixtures thereof.

9. The composition as claimed in claims 1 or 2, wherein the water soluble manganese salts comprise at least one of manganese acetate; manganese diacetate; manganese gluconate; manganese bromide; manganese chloride; manganese iodide; manganese nitrate; manganese citrate; manganese bicarbonate; manganese ammonium phosphate; and complexes, derivatives or mixtures thereof.

10. The composition as claimed in claims 1 or 2, wherein the manganese salts comprise at least one of manganese oxide; manganese(II) oxide, MnO (Ferrite Grade); Manganese(II,III) oxide, Mn₃O₄; Manganese(III) oxide, Mn₂O₃; Manganese(VI) oxide, MnO₃; Manganese(VII) oxide, Mn₂O₇; manganese hydroxide; manganese phosphate; manganese dioxide; manganese carbonate; manganese oxalate; manganese borate; manganese acetate; manganese diacetate; manganese gluconate; manganese bromide; manganese chloride; manganese iodide; manganese nitrate; manganese citrate; manganese bicarbonate; manganese ammonium phosphate,, manganese sulphate and complexes, derivatives or mixtures thereof.

10. The water dispersible granular composition as claimed in claim 2, wherein the composition is in the form of microgranules in a size range of 0.1 mm to 1.5 mm.

11. The water dispersible granular composition as claimed in claim 2, wherein the granules of the composition comprise particles in the size range of 0.1 to 10 microns.

12. The liquid suspension composition as claimed in claim 1, wherein the weight ratio of one or more of manganese salts, complexes, derivatives or mixtures thereof to elemental Sulphur is 1: 600 to 55:1.

13. The liquid suspension composition as claimed in claim 1, wherein the weight ratio of one or more of manganese salts, complexes, derivatives or mixtures thereof to elemental Sulphur is 1: 50 to 35:1; preferably the weight ratio of one or more of manganese salts, complexes, derivatives or mixtures thereof to elemental Sulphur is 1: 10 to 10:1 and more preferably the weight ratio of one or more of manganese salts, complexes, derivatives or mixtures thereof to elemental Sulphur is 1: 2.5 to 1.5:1.

14. The water dispersible granular composition as claimed in claim 2, wherein the weight ratio of one or more of manganese salts, complexes, derivatives or mixtures thereof to elemental Sulphur is 1: 90 to 70:1; preferably the weight ratio of one or more of manganese salts, complexes, derivatives or mixtures thereof to elemental Sulphur is 1:90 to 3.5:1.

15. The liquid composition as claimed in claim 1, wherein the viscosity of the composition is in the range of 10 cps to 1200 cps.

16. The liquid composition as claimed in claim 1, wherein the viscosity of the composition is in the range of 10 cps to 500 cps.

17. The liquid composition as claimed in Claim 1, wherein the structuring agent comprises one or more of thickeners, viscosity modifiers, tackifiers, suspension aids, rheology modifiers and anti-settling agents.

18. The liquid suspension composition as claimed in Claim 1, wherein the composition comprises one or more agrochemically acceptable excipients selected from one or more surfactants.

19. The liquid suspension composition as claimed in Claim 1, wherein the composition further comprises one or more agrochemically acceptable excipients selected from one or more of dispersing agents, wetting agents, water miscible solvents, humectants, spreading agents, penetrating agents, sticking agents, drift reducing agents, ultraviolet absorbents, UV ray scattering agents, preservatives, stabilizers, buffers or pH adjusters or neutralizing agents, antifreezing agents or freeze point depressants, antifoaming agents and anticaking agents.

20. The compositions as claimed in Claims 1 or 2, wherein the suspensibility of the composition is at least 30%.

21. The compositions as claimed in the claims 1 or 2, wherein the composition further optionally comprises at least one additional active ingredient selected from one or more micronutrients, macronutrients, bio stimulants, pesticidal actives and/or fertilizers selected from nitrogen fertilizers, phosphorous fertilizers, potassium fertilizers and salts, complexes, derivatives or mixtures thereof.

22. The compositions as claimed in the claims 1 or 2, wherein the micronutrients, their salts, complexes, derivatives or mixtures thereof are present in the range of 0.1% to 70% by weight of the total composition, preferably in the range of 0.1% to 40% by weight of the total composition.

23. The water dispersible granular composition as claimed in claim 2, wherein the composition further comprises one or more agrochemically acceptable excipients selected from disintegrating agents, wetting agents, binders or fillers or carriers or diluents, buffers or pH adjusters or neutralizing agents, antifoaming agents, drift reducing agents, anticaking agents, spreading agents, penetrating agents, sticking agents and mixtures thereof.

24. The water dispersible granular composition as claimed in claim 2, wherein the composition has a dispersibility of at least 40%.

25. The process of preparation of the liquid suspension crop nutrition and fortification composition as claimed in claim 1, wherein the process comprises: milling a blend of elemental sulphur, at least one manganese salts, complexes, derivatives or mixtures thereof, at least one structuring agent and at least one agrochemically acceptable excipient to obtain a slurry or wet mix with a particle size range of 0.1 micron to 20 microns.

26. The process of preparation of the water dispersible granular composition for crop nutrition and fortification as claimed in claim 2, wherein the process comprises:

- a. milling a blend of elemental sulphur, at least one manganese salts, complexes, derivatives or mixtures thereof and at least one dispersing agent to obtain a slurry or wet mix; and,
- b. drying the wet mix to obtain the water dispersible granular composition with a granule size in the range of 0.1 mm to 2.5 mm and comprising particles in the size range of 0.1 micron to 20 microns.

27. The process of Claim 25, wherein the milling step further comprises adding at least one further agrochemically acceptable excipient selected from disintegrating agents, wetting agents, binders or fillers or carriers or diluents, buffers or pH adjusters or neutralizing agents, antifoaming agents, drift reducing agents, anticaking agents, spreading agents, penetrating agents, and sticking agents.

28. A method of improving plant health or yield, the method comprising treating at least one of a plant, a plant propagation material, locus or parts thereof, a seed, seedling or surrounding soil with the crop nutrition and fortification composition as claimed in the claims 1 or 2.

29. The composition as claimed in claims 1 or 2, is as at least one of a fertilizer composition, a nutrient composition, a crop strengthener composition, a soil conditioner composition and a yield enhancer composition.

I Claim,

1. A liquid suspension composition for crop nutrition and fortification, wherein the liquid composition comprises:
elemental sulphur in the range of from 1%-60% by weight of the total composition;
at least one manganese salt, its complexes, derivatives or mixtures thereof in the concentration in the range of from 0.1%-55% by weight of the total composition;
at least one agrochemically acceptable excipient; and
at least one structuring agent in the range of 0.01 %-5% by weight of the total composition; and,
wherein the composition comprises particles in the size range of from 0.1 micron to 20 microns.
2. A water dispersible granular composition for crop nutrition and fortification composition, wherein the composition comprises:
elemental sulphur in the range of from 1%-90% by weight of the total composition;
at least one manganese salt, its complexes, derivatives or mixtures thereof in the range of from 0.1%-70% by weight of the total composition; and,
at least one dispersing agent in the range of from 1% - 30% w/w of the total composition; and,
wherein the granules of the composition are in the range of from 0.1-2.5 mm and comprise particles in the size range of from 0.1 micron to 20 microns.
3. The composition as claimed in the claims 1 or 2, wherein the manganese salts comprise at least one water soluble salt and water insoluble salts or complexes or derivatives or mixtures thereof.

4. The composition as claimed in claims 1 or 2, wherein the manganese salts comprise at least one water insoluble manganese salts or complexes or derivatives or mixtures thereof.

5. The composition as claimed in claims 1 or 2, wherein the water insoluble manganese salts comprise at least one of manganese oxide; manganese(II) oxide, MnO (Ferrite Grade); Manganese(II,III) oxide, Mn₃O₄; Manganese(III) oxide, Mn₂O₃; Manganese(VI) oxide, MnO₃; Manganese(VII) oxide, Mn₂O₇; trimanganesetetroxide or manganic oxide or hausmannite; manganese hydroxide; manganese dihydroxide; manganous hydroxide; rhodochrosite; manganese phosphate; manganese phosphate heptahydrate; manganese (II) phosphate; manganese diphosphate; manganese phosphate tribasic; carbonyl manganese; manganese dioxide; manganese dioxide, (manganese(IV) oxide), MnO₂; manganese diselenide; manganese tetroxide; manganese carbonate; manganese molybdate; manganese selenide; manganese telluride; manganese titanate; manganese nitride; manganese oxalate; manganese ferrocyanide; manganese fluoride; manganese borate; manganese sulphide; dimanganese trioxide; manganese peroxide; manganese ferrocyanide; Manganese sulphide; manganese binoxide; manganese black; pyrolusite; manganese superoxide and complexes, derivatives or mixtures thereof.

6. The composition as claimed in claims 1 or 2, wherein the water insoluble manganese salts comprises at least one of manganese oxide; manganese(II) oxide, MnO (Ferrite Grade); Manganese(II,III) oxide, Mn₃O₄; Manganese(III) oxide, Mn₂O₃; Manganese(VI) oxide, MnO₃; Manganese(VII) oxide, Mn₂O₇; manganese hydroxide; manganese phosphate; manganese dioxide; manganese carbonate; manganese oxalate; manganese borate and complexes, derivatives or mixtures thereof.

7. The composition as claimed in claims 1 or 2, wherein the manganese salts comprise at least one water soluble manganese salts or complexes or derivatives or mixtures thereof.

8. The composition as claimed in claims 1 or 2, wherein the water soluble manganese salts comprise at least one of dimanganese trioxide, manganese acetate, manganese diacetate, manganese gluconate, manganese bromide, manganese chloride, manganese iodide, manganese succinate, manganese fumarate, manganese nitrate, manganese dichloride, sodium manganate, potassium permanganate, manganese citrate, manganese bicarbonate, manganese dichromate, manganese fluorosilicate, manganese ammonium phosphate; Manganese zinc ferrite, Manganese chlorate tetrahydrate, manganese bromide, sodium manganate, manganese sulphate, , manganese chelate and complexes, derivatives or mixtures thereof.

9. The composition as claimed in claims 1 or 2, wherein the water soluble manganese salts comprise at least one of manganese acetate; manganese diacetate; manganese gluconate; manganese bromide; manganese chloride; manganese iodide; manganese nitrate; manganese citrate; manganese bicarbonate; manganese ammonium phosphate; and complexes, derivatives or mixtures thereof.

10. The composition as claimed in claims 1 or 2, wherein the manganese salts comprise at least one of manganese oxide; manganese(II) oxide, MnO (Ferrite Grade); Manganese(II,III) oxide, Mn_3O_4 ; Manganese(III) oxide, Mn_2O_3 ; Manganese(VI) oxide, MnO_3 ; Manganese(VII) oxide, Mn_2O_7 ; manganese hydroxide; manganese phosphate; manganese dioxide; manganese carbonate; manganese oxalate; manganese borate; manganese acetate; manganese diacetate; manganese gluconate; manganese bromide; manganese chloride; manganese iodide; manganese nitrate; manganese citrate; manganese bicarbonate; manganese ammonium phosphate;, manganese sulphate and complexes, derivatives or mixtures thereof.

10. The water dispersible granular composition as claimed in claim 2, wherein the composition is in the form of microgranules in a size range of 0.1 mm to 1.5 mm.

11. The water dispersible granular composition as claimed in claim 2, wherein the granules of the composition comprise particles in the size range of 0.1 to 10 microns.

12. The liquid suspension composition as claimed in claim 1, wherein the weight ratio of one or more of manganese salts, complexes, derivatives or mixtures thereof to elemental Sulphur is 1: 600 to 55:1.

13. The liquid suspension composition as claimed in claim 1, wherein the weight ratio of one or more of manganese salts, complexes, derivatives or mixtures thereof to elemental Sulphur is 1: 50 to 35:1; preferably the weight ratio of one or more of manganese salts, complexes, derivatives or mixtures thereof to elemental Sulphur is 1: 10 to 10:1 and more preferably the weight ratio of one or more of manganese salts, complexes, derivatives or mixtures thereof to elemental Sulphur is 1: 2.5 to 1.5:1.

14. The water dispersible granular composition as claimed in claim 2, wherein the weight ratio of one or more of manganese salts, complexes, derivatives or mixtures thereof to elemental Sulphur is 1: 90 to 70:1; preferably the weight ratio of one or more of manganese salts, complexes, derivatives or mixtures thereof to elemental Sulphur is 1:90 to 3.5:1.

15. The liquid composition as claimed in claim 1, wherein the viscosity of the composition is in the range of 10 cps to 1200 cps.

16. The liquid composition as claimed in claim 1, wherein the viscosity of the composition is in the range of 10 cps to 500 cps.

17. The liquid composition as claimed in Claim 1, wherein the structuring agent comprises one or more of thickeners, viscosity modifiers, tackifiers, suspension aids, rheology modifiers and anti-settling agents.

18. The liquid suspension composition as claimed in Claim 1, wherein the composition comprises one or more agrochemically acceptable excipients selected from one or more surfactants.

19. The liquid suspension composition as claimed in Claim 1, wherein the composition further comprises one or more agrochemically acceptable excipients selected from one or more of dispersing agents, wetting agents, water miscible solvents, humectants, spreading agents, penetrating agents, sticking agents, drift reducing agents, ultraviolet absorbents, UV ray scattering agents, preservatives, stabilizers, buffers or pH adjusters or neutralizing agents, antifreezing agents or freeze point depressants, antifoaming agents and anticaking agents.

20. The compositions as claimed in Claims 1 or 2, wherein the suspensibility of the composition is at least 30%.

21. The compositions as claimed in the claims 1 or 2, wherein the composition further optionally comprises at least one additional active ingredient selected from one or more micronutrients, macronutrients, bio stimulants, pesticidal actives and/or fertilizers selected from nitrogen fertilizers, phosphorous fertilizers, potassium fertilizers and salts, complexes, derivatives or mixtures thereof.

22. The compositions as claimed in the claims 1 or 2, wherein the micronutrients, their salts, complexes, derivatives or mixtures thereof are present in the range of 0.1% to 70% by weight of the total composition, preferably in the range of 0.1% to 40% by weight of the total composition.

23. The water dispersible granular composition as claimed in claim 2, wherein the composition further comprises one or more agrochemically acceptable excipients selected from disintegrating agents, wetting agents, binders or fillers or carriers or diluents, buffers or pH adjusters or neutralizing agents, antifoaming agents, drift reducing agents, anticaking agents, spreading agents, penetrating agents, sticking agents and mixtures thereof.

24. The water dispersible granular composition as claimed in claim 2, wherein the composition has a dispersibility of at least 40%.
25. The process of preparation of the liquid suspension crop nutrition and fortification composition as claimed in claim 1, wherein the process comprises: milling a blend of elemental sulphur, at least one manganese salts, complexes, derivatives or mixtures thereof, at least one structuring agent and at least one agrochemically acceptable excipient to obtain a slurry or wet mix with a particle size range of 0.1 micron to 20 microns.
26. The process of preparation of the water dispersible granular composition for crop nutrition and fortification as claimed in claim 2, wherein the process comprises:
- a. milling a blend of elemental sulphur, at least one manganese salts, complexes, derivatives or mixtures thereof and at least one dispersing agent to obtain a slurry or wet mix; and,
 - b. drying the wet mix to obtain the water dispersible granular composition with a granule size in the range of 0.1 mm to 2.5 mm and comprising particles in the size range of 0.1 micron to 20 microns.
27. The process of Claim 25, wherein the milling step further comprises adding at least one further agrochemically acceptable excipient selected from disintegrating agents, wetting agents, binders or fillers or carriers or diluents, buffers or pH adjusters or neutralizing agents, antifoaming agents, drift reducing agents, anticaking agents, spreading agents, penetrating agents, and sticking agents.
28. A method of improving plant health or yield, the method comprising treating at least one of a plant, a plant propagation material, locus or parts thereof, a seed, seedling or surrounding soil with the crop nutrition and fortification composition as claimed in the claims 1 or 2.

29. The composition as claimed in claims 1 or 2, is as at least one of a fertilizer composition, a nutrient composition, a crop strengthener composition, a soil conditioner composition and a yield enhancer composition.

ANNEXURE A: PHYSICAL PROPERTY DATA

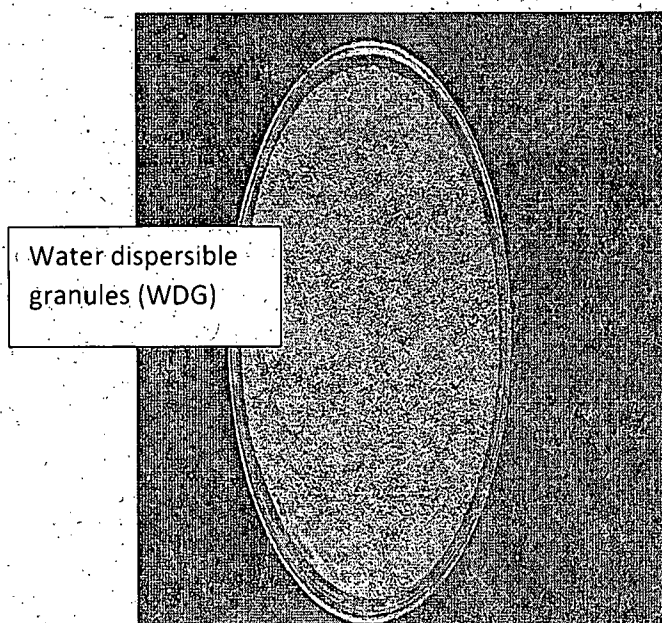


Figure 1A



Figure 1B

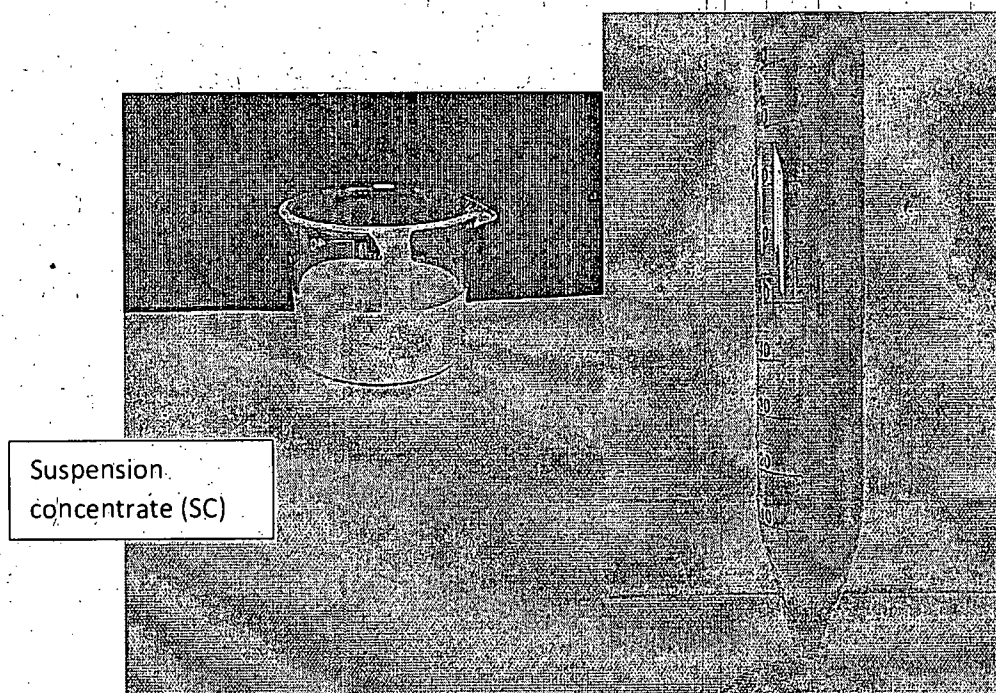


Figure 1C

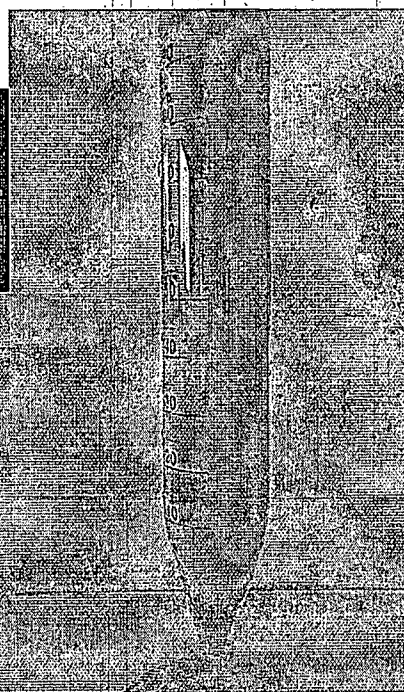
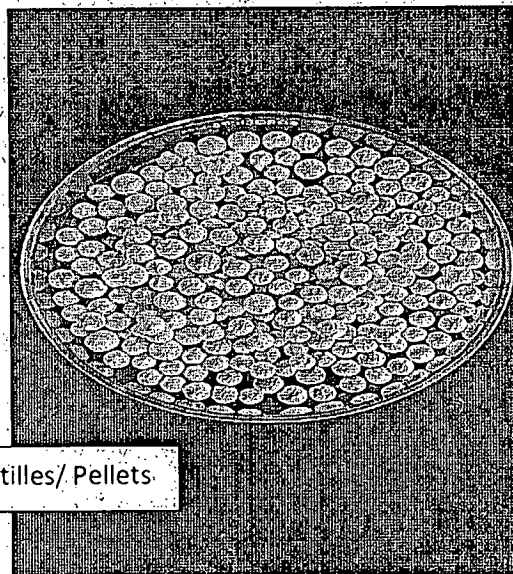


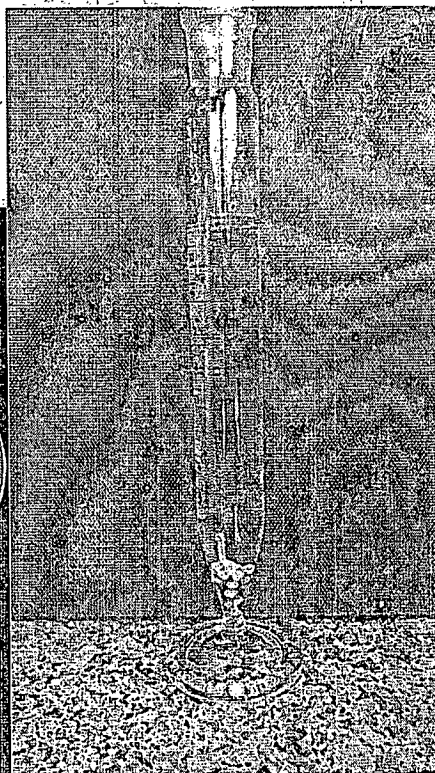
Figure 1D

Figure 1: S + Manganese salt composition (As per claimed invention)

ANNEXURE A: PHYSICAL PROPERTY DATA



Pastilles/ Pellets



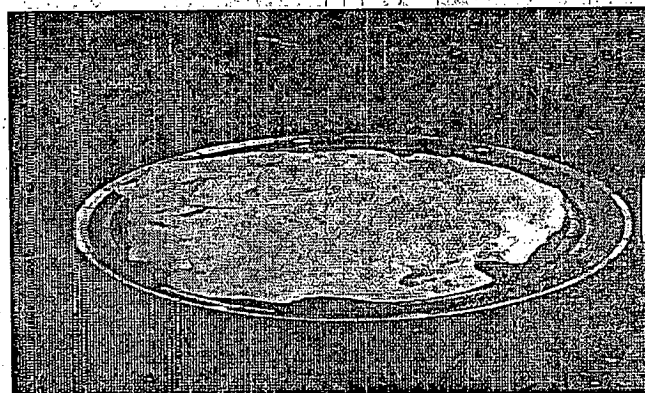
Settling of Pellets /
No Dispersion

Figure 2A

Figure 2B

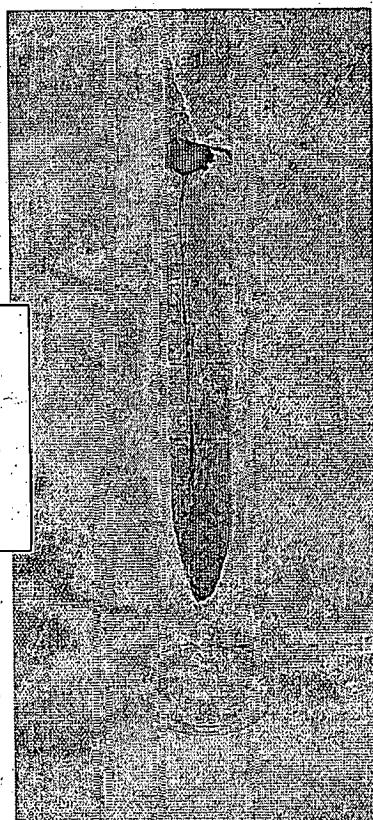
Figure 2: US6749659 prior art sample (EnersulInc Sample)

ANNEXURE A: PHYSICAL PROPERTY DATA

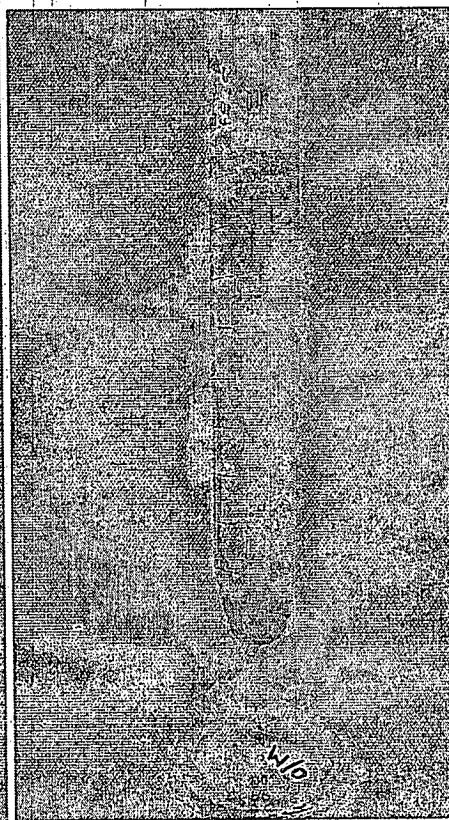


Thick paste

Figure 3A



Thick paste either floats at the top or settles at the bottom in water.



Non uniform dispersion of the sample after 24 Hours.

Figure 3B

Figure 3C

Figure 3: US2017283334A1 prior art sample (Sun chemical corp)