

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO	
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DEP: 2020 DIRECCION DE NUEVAS CREACIONES	EVE: 379 FASE NACIONAL INCLUIDO CAPITULO II
TRA: 11 PCT-PATENTE DE INVENCION CAPITULOS I Y II	FOLIOS: 12
ACT: 519 PRESENTACION	

DIRECCIÓN DE NUEVAS CREACIONES

2020
Bogotá, D.C.,

Abogado(a)/Señor(a)
JUAN PABLO CADENA SARMIENTO

Asunto: Radicación: 12-22052- -4
 Trámite: 11
 Evento: 379
 Actuación: 519
 Oficio: 698
 Folios: 12

Patente de Invención	X			Patente de Modelo de Utilidad	
Vía Nacional					
Vía PCT (Fase Nacional)	X	Capítulo I		Capítulo II	X
No. Solicitud Internacional	PCT/US2009/055510				
Fecha de Presentación Internacional	31/08/2009				

Como resultado del examen de fondo realizado, con fundamento en el Artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se comunica:

1. Documentos estudiados

Descripción:	Radicado 12-022052-00000-0000	08/febrero/2012
Reivindicaciones:	Radicado 12-022052-00000-0000	08/febrero/2012

2. Objeto de la invención

De acuerdo con lo establecido en el numeral 1.2.2.2 del capítulo primero del Título 10 de la Circular Única para efectos del examen de patentabilidad, se tendrá en cuenta la tasa pagada por la solicitante al momento de comenzar el examen para las reivindicaciones adicionales; esto es que cuando la solicitud contenga más de diez (10) reivindicaciones y no se haya pagado la tasa complementaria, sólo se estudiarán las cubiertas por la tasa pagada. En el presente caso se estudiarán las reivindicaciones 1 a 14 del capítulo reivindicatorio radicado bajo N° 12-022052-00000-0000.

Título de la solicitud: “PIGMENTO CON MODIFICACIÓN DE LA SUPERFICIE”

El problema planteado en esta solicitud consiste en proporcionar composiciones

limpiadoras que permitan la deposición de un pigmento sobre la piel sin que este sea removido por la acción limpiadora de la composición.

Para resolver este problema técnico la solicitud en estudio proporciona una composición de limpieza que comprende una partícula de pigmento que está recubierta con Policuaturnio-67.

El objeto de la presente solicitud se relaciona con la Clasificación Internacional de Patentes (CIP): A61K 8/26, 8/29 8/73 y A61Q 19/10.

3. Reivindicaciones relativas a un uso o a un segundo uso (Art 14 y 21 D 486)

El uso de las reivindicaciones 8 a 14 no es patentable, de acuerdo con el Art 14.

4. De la solicitud de patente

Título

El título no corresponde con el objeto de la solicitud porque la solicitud hace referencia una composición limpiadora que permite la deposición de pigmentos sobre la piel, por lo cual se sugiere a la solicitante hacer la corrección necesaria. Por lo que se sugiere que el título incluya las características esenciales de la solicitud.

Reivindicaciones (Art 30 D 486, Art 22 PCT)

La reivindicación 1 no es clara ni concisa porque la utilización de la expresión “una partícula pigmentaria.” refiriéndose a los elementos constituyentes de una composición no es limitativa y es imprecisa, lo cual no permite distinguir la invención del estado de la técnica. Por lo que se hace indispensable que el solicitante indique la denominación común de los compuesto que cumplen con la condiciones de “una partícula pigmentaria”, se sugiere incluir en la reivindicación independientes las características técnicas esenciales de la reivindicación dependiente 2.

El alcance de la reivindicación 1 va más allá que el contenido divulgado en la descripción y no permite determinar el efecto técnico, se invita al peticionario modificar la reivindicación 1 para restringir la solicitud a una razonable generalización del tipo de composiciones que han sido elaboradas ó probadas, es decir, que se encuentran debidamente sustentados en la descripción.

La reivindicación 5 no es clara porque la utilización de las expresiones “un surfactante” refiriéndose a los elementos constituyentes de una composición no son limitativas y son imprecisas, porque definen los elementos en términos de su función, lo cual no permite distinguir la invención del estado de la técnica. Por lo que se hace indispensable que el solicitante indique la denominación común de los excipientes que cumplen con la condiciones de “un surfactante”.

La reivindicaciones 8 a 14 no pueden ser objeto de patente de acuerdo con lo establecido en la Decisión 486 de 2000 de la Comunidad Andina de Naciones, por cuanto están referidas a un uso, aunque el solicitante las encabeza con la palabra ‘método’, en realidad están referidas al uso de la composición de la reivindicación 1. Nótese que la reivindicación 8 claramente indica como paso único del supuesto método ‘la aplicación de la composición de la reivindicación 1 a una superficie’, y por lo tanto no es posible conceder para ellas el privilegio de patente solicitado

5. Determinación del Estado de la Técnica

El estado de la técnica se determinó con base en la fecha de presentación internacional: agosto 31 de 2009, y se encontraron los siguientes documentos que anticipan el objeto de esta solicitud:

Ítem	Documento	Título	Fecha de Publicación*
D1	MX PA05011949	"Método para depositar partículas brillantes sobre superficies queratinosas a partir de composiciones que se retiran por enjuague"	02/febrero/2006
D2	Jordan. Susan. y otros Cosmetic Nanotechnology Chapter 2, Págs. 59–71	"Effect of Hydrophobic Substitution on Cationic Conditioning Polymers"	12/abril/2007

El documento D1^[1] divulga composiciones que se retiran por enjuague y depositan partículas brillantes en la piel (Fl. 1, resumen).

El documento D2 ^[2] divulga el efecto de la arquitectura del polímero catiónico en la deposición de ingredientes activos insolubles en agua a partir champús y formulaciones para el lavado corporal (Pág. 69, conclusiones).

6. Examen de Patentabilidad (Art 14 D486)

Nivel inventivo (Art18 D486)

La reivindicación 1 consiste en: *"Una composición de limpieza que comprende una partícula de pigmento que esta recubierta con Policuaturnio-67"* (Pág. 24 del radicado N°. 12-022052-00000-0000).

Comparación de las características técnicas esenciales, con las del estado de la técnica:

Características esenciales	D1	D2
Una composición de limpieza que comprende:	Una composición de limpieza que comprende: (Fl. 47, Ejs. 13-17)	Enseña el uso de los policuaturnios-10 y 67 (Pág. 61, materiales y métodos)
una partícula de pigmento Reivindicación 2 donde la partícula es de al menos un material seleccionado a partir: mica/dióxido de titanio, mica/óxido de hierro, mica, dióxido de titanio, los óxidos de zinc, los óxidos de hierro, los óxidos de cromo, sílice, talco y caolín	mica/dióxido de titanio/simeticona	en formulaciones para el lavado corporal para mejorar la sensación de la piel durante el lavado y después aumentan la deposición de aceites o activos insolubles como la silicona sobre el cabello (Págs. 65-66)
recubierta con Policuaturnio-67	un polímero catiónico	

El documento D1 se considera el estado de la técnica más cercano a la solicitud definida en la reivindicación 1 porque divulga composiciones limpiadoras que comprenden mica/dióxido de titanio/simeticona, cloruro de hidroxipropiltrimonio de guar y un polímero catiónico que permite que los ingredientes insolubles se depositen en la piel (Pág. 47, Ejs. 13-17). Adicionalmente, el documento D1 divulga el triisosteato isopropil titanio como uno de los posibles agentes para el tratamiento hidrófobo de las partículas (Pág. 16, líneas 4 a 7)

La diferencia entre la solicitud, definida en la reivindicación 1 y la composición divulgada en el documento D1 consiste en que la solicitud define que el polímero catiónico es policuaturnio-67 mientras el documento D1 refiere composiciones con polímeros catiónicos de deposición tipo policuaturnio (Pág. 33, líneas. 4-11), sin embargo, el documento D1 no ejemplifica composiciones con polímeros tipo

1: http://worldwide.espacenet.com/publicationDetails/originalDocument?FT=D&date=20060202&DB=EPODOC&locale=en_EP&CC=MX&NR=PA05011949A&KC=A&ND=2
2: <http://pubs.acs.org/doi/abs/10.1021/bk-2007-0961.ch002>

Policuaternio.

El efecto que logra al seleccionar como polímero catiónico el Policuaternio-67 en las composiciones limpiadoras es obtener composiciones limpiadoras que depositan las partículas insolubles en la piel.

Por lo tanto, el problema técnico objetivo que pretende resolver esta solicitud se puede formular así: cómo obtener composiciones limpiadoras alternativas que permitan depositar partículas insolubles sobre la piel.

Sin embargo, el documento D2 revela el uso de polímeros catiónicos como el policuaternio 10 y 67 en formulaciones para el lavado que aumentan la deposición de aceites o activos insolubles sobre superficies corporales como el cabello (Pág. 2, líneas 4 a 7 y Pág. 9, líneas 1 a 11).

En consecuencia, la persona del oficio normalmente versada en la materia, estaría motivada a seleccionar el policuaternio-67 como polímero catiónico en las composiciones divulgadas en el documento D1 de la forma sugerida en el documento D2 para llegar así al objeto de la reivindicación 1 de la solicitud. Por lo cual se considera obvia.

Puesto que las reivindicaciones dependientes 2-7 no mencionan características inventivas adicionales tampoco se pueden considerar inventivas.

7. Conclusión

Los requisitos de Patentabilidad de la presente solicitud están afectados así:

Item	Documento	Reivindicaciones afectadas	Requisito que afecta
D1	MX PA05011949	1-7	Nivel inventivo
D2	Jordan. Susan. y otros Cosmetic Nanotechnology Chapter 2, Págs. 59–71	1-7	Nivel inventivo

En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que debe dar respuesta dentro del término de sesenta (60) días contados a partir del día siguiente de la fecha de notificación de la presente comunicación. En caso de no dar respuesta al presente requerimiento, o si a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Se invita al solicitante se sirva indicar, si así lo considera, su renuncia al término faltante de sesenta (60) días para dar respuesta a este requerimiento y presentarla por escrito.

Finalmente, se le recuerda al solicitante que si como respuesta a este requerimiento llegara a modificar el capítulo reivindicatorio y éste contenga más de diez (10) reivindicaciones, no pagará la tasa de modificación voluntaria pero sí la correspondiente al pago por reivindicación adicional.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Única No. 10 de 2001.



JOSÉ LUIS SALAZAR LÓPEZ
Director de Nuevas Creaciones (c)

El anterior requerimiento fue notificado por fijación en lista, de fecha 2014-01-28

Elaboró: Lenin Roberto Guerrero
Revisó: Jeny Paola Villate Becerra

Chapter 2

Effect of Hydrophobic Substitution on Cationic Conditioning Polymers

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Cationic cellulosic polymers are formulated with anionic surfactants in shampoos and body washes as conditioners and deposition aids. During dilution, the polymer and surfactant undergo a series of association and microstructure changes: from a condensed network to globular aggregation to inter-chain association with micelles. Cationic polymer structure impacts the polymer/surfactant interaction. The addition of hydrophobic chains on the polymers significantly changes deposition and conditioning properties. In general, deposition of benefit agents from shampoos and body washes increases in the presence of these modified polymers. Conditioning in clear formulations also improves. These performance changes depend on the absolute molar substitution of the hydrophobic moiety as well as the surfactant system. The presence of even very low levels of hydrophobe alters interfacial reactivity with surfactants and surfaces influencing both coacervate formation and deposition.

Polyquaternium-10 (PQ-10) is the INCI name for cationic (trimethyl ammonium) hydroxyl ethyl cellulose (HEC) polymers that are used in shampoo systems to impart conditioning properties to hair including good feel properties and manageability. More recently, these polymers are used in body wash formulations to improve skin feel during washing and after drying and improved deposition of oils. Nomenclature for commercial PQ10 polymers reflects the relative molecular weight and charge density. The first two letters represent charge density (JR:~1.7% nitrogen, LR: ~1.0% Nitrogen). The following numbers/letters indicate relative molecular weight (400:medium, 30M:-high).

In shampoo and body wash formulations, the cationic polymer and surfactant exist together in a single phase. Upon dilution during washing and rinsing, cationic HEC polymers form a complex with the surfactant system that phase separates from the bulk solution. This phase separation (or coacervation) is a well-known phenomenon known as the "Lochhead Effect" (1-3). The coacervate is a gel like phase that contains a high level of cationic polymer that deposits on negatively charged substrates, forming a clear film. The haze formed by coacervate formation is readily measured. In addition, coacervates aid in the deposition of insoluble actives, such as silicone (4,5). Deposition efficiency is dependent on polymer molecular weight as well as cationic charge density. Recent work by Zhou, et al. (6) investigates molecular weight effects and ethylene oxide chain length on the phase behavior of cationic hydroxyethyl cellulose at different concentrations of sodium dodecyl sulfate (SDS). These phase changes include a condensed network, globular aggregation (coacervation) and inter-chain association with micelles (Figure 1).

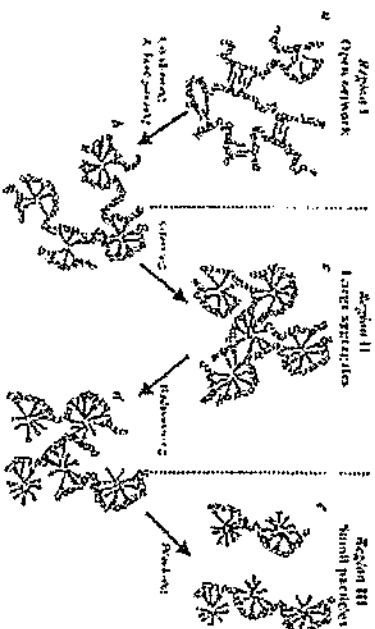


Figure 1. Structural models of cationic HEC-SDS complex at each phase evolution stage. (Reproduced from reference 6. Copyright 2004 American Chemical Society.)

Zhou, et al. show at low surfactant, the polymer is soluble with a hydrodynamic radius (Rh) about 100 nm near the phase boundary. As surfactant concentration increases, Rh increases and phase separation occurs. As the upper boundary is approached, particle size is maximized. Addition of surfactant to concentrations above the upper phase boundary indicates resolubilization of the polymer and decreased Rh. The complex microstructure relationships between polymer and surfactants predict additional functional and performance effects upon the addition of hydrophobic chains onto the polymer backbone (Figure 2).

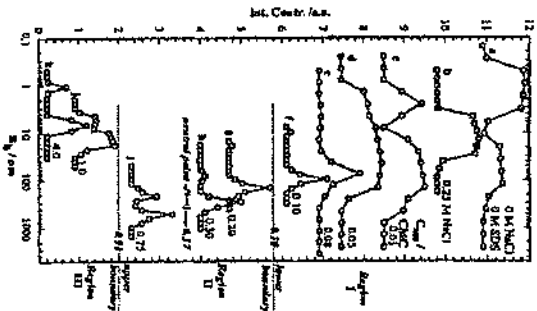


Figure 2. Apparent hydrodynamic radius (Rh) distribution of 0.2 wt % EO22MW110 solution in 0.25 M NaCl (b) and in differently concentrated SDS solution (c-k). (Reproduced from reference 6, Copyright 2004 American Chemical Society.)

Materials and Methods

All materials were used as received.

Cationic polymers: PQ10 and PQ67 from Amerchol Corporation
Surfactants (Cognis): Standapol ES-2 (sodium laureth sulfate, SLES-2),

Velvetex BK-35 (cocamidopropyl betaine, CAPB), Velvetex CDC (disodium cocamphodiacetate, DSCADA)

Silicone: Dow Corning 2-1664 emulsion

Hair: International Hair Importers and Products

Vitro-Skin® IMS Inc.

Wet combing: Wet combing is measured using a Dia-Stron Miniature Tensile Tester. The force required to pull a comb through a wet hair tress treated with surfactant alone and then surfactant plus polymer is measured. Five grams of hair is washed with 0.5 grams of a shampoo, and rinsed at constant temperature. The difference in force required to comb the hair tress is wet comb reduction.

Coacervate study: Haze measurements were performed using a nephelometer or a Nippon Denshoku 300A hazemeter 2 minutes after diluting formulation 2.5 to 20 times with water and mixing at room temperature.

Silicone deposition: The amount of silicone deposited on hair after shampooing was measured. Five grams of hair was washed with 0.5 grams of a shampoo, and rinsed at constant temperature. Hair was extracted with a 1:1 mixture of methyl butyl ketone and toluene. Atomic absorption spectroscopy was used to measure silicone content; reporting µg silicone/g hair.

Sunflower seed oil deposition: A 3-6 cm piece of Vitro-skin® was washed with 0.15 mL body wash and rinsed at constant temperature. Dried skin was extracted with heptane and analyzed for SSO using gas chromatography.

Results and Discussion

The effect of molecular weight and charge density of cationic HEC polymers (Polyquaternium 10 or PQ10) on silicone (0.5 µ dimethicone) deposition from a simple shampoo formulation (15.5% SLES-2 / 2.6% DSCADA, 0.25% polymer, 1% silicone) is shown in Figure 3. Both parameters affect the overall performance of the polymers in depositing silicone. This data is consistent with coacervate formation as a function of dilution level.

The haziness of the diluted solution was monitored as an indicator of coacervate formation and was measured with a Nephelometer 2 minutes after dilution. In this case, the coacervate peak-height increases with molecular weight, suggesting more coacervate leads to increased deposition and may simply be a function of the increased ability of the larger polymer to flocculate the insoluble silicone onto the hair rather than a change in interactions in solution. Coacervate peaks shift significantly (from 5 to 10 fold dilution), however, as the charge density decreases (Figure 4). This shift is independent of surfactant base (Shampoo 1: 15.5% sodium laureth sulfate (SLES-2) / 2.6% cocamidopropyl betaine (CAPB), Shampoo 2: 15.5% SLES-2 / 2.6% disodium cocamphodiacetate (DSCADA) Data not shown). Differences in silicone deposition coupled with coacervate peak shifts at varying charge density suggest

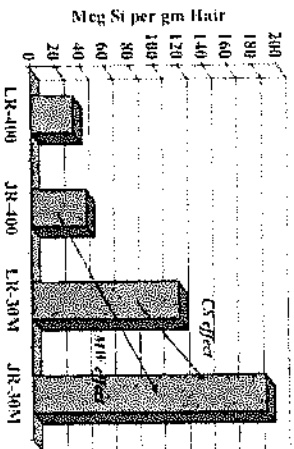


Figure 3. Silicone deposition onto European brown hair using PQ10. Low molecular weight polymers: -400, high molecular weight polymers: -30M; low charge density: LR, high charge density: JR. (15.5% SLES-2 / 2.6% DSCADA, 0.25% polymer, 1% silicone)

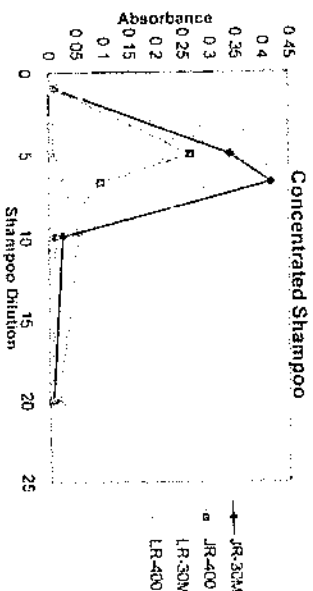


Figure 4. Coacervate haze curves of PQ10 polymers measured using a Nephelometer. Low molecular weight polymers: -400, high molecular weight polymers: -30M; low charge density: LR, high charge density: JR. (15.5% SLES-2 / 2.6%CAPB, 0.5% polymer) (See page 1 of color inserts.)

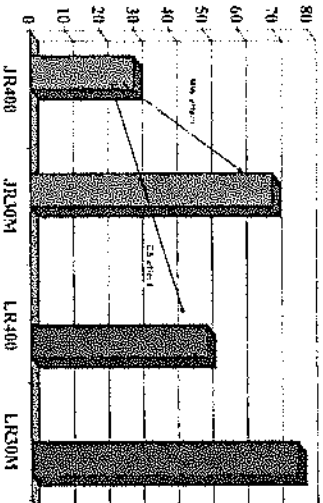


Figure 5. Wet combing reduction of single bleached hair washed with shampoo containing PQ10 polymers. Low molecular weight polymers: -400, high molecular weight polymers: -30M; low charge density: LR, high charge density: JR. (15.5% SLES-2 / 2.6% DSCADA, 0.5% polymer)

Based on the data in Figures 3-5, both silicone deposition and conditioning are favored by higher molecular weight polymers, regardless of charge substitution. Interestingly, early peak dilution (higher charge) favors silicone deposition while late peak dilution and wide coacervation zone (lower charge) favor conditioning. PQ10 also effects sunflower seed oil (SSO) deposition from body wash formulations. Similar to shampoo systems, increased molecular weight and charge density result in increased SSO deposition onto skin (data not shown).

According to Zhou, et al (6) differences in polymer surfactant microstructures on dilution are apparent with cationic HEC polymers containing lower levels of ethylene oxide (EO) substitution from typical PQ10. Less EO suggests the polymer will be less hydrophilic and have more hydrophobic

the interaction of the polymer with surfactant is highly dependent on charge density. Wet combing studies are used to measure relative conditioning of the hair. The force required to pull a comb through wet hair is measured with a Diasiron and compared to a control. The more wet comb force reduction, the better the conditioning. Polymer dependence on conditioning effects, as measured by wet combing, show that as molecular weight increases, wet combing increases. In contrast, while charge increases, wet combing decreases. The effect of molecular weight, however, appears to partially compensate for the effect of charge on overall wet combing (Figure 5).

character. The change in microstructure observed with low EO polymers suggests increased hydrophobicity of cationic HEC will affect interaction with surfactants and hence polymer performance. Zhou, et al. determined polymers with low EO substitution have a broadened concave zone (suggesting better wet combing) and increased Rh (suggesting better deposition). As was shown in Figure 2, the largest Rh occurs at high surfactant concentration (low dilution). Since lower peak dilution corresponds to better deposition (Figures 3 & 4), it is possible a more hydrophobic polymer can both increase peak area (maximize wet comb) and maintain maximum peak dilution at low dilution levels (maximize deposition).

In order to understand the effect of hydrophobicity on cationic HEC, a new polymer family, Polyquaternium 67 (PQ 67), was developed. PQ 67 is a high viscosity quaternized hydroxyethyl cellulose (HEC) polymer with cationic substitution of trimethyl ammonium and dimethyldodecyl ammonium (Figure 6). For experiments in shampoo systems, cationic substitution was fixed at ~ 0.2, which corresponds to a weight-percent nitrogen of ~1.0%, while substitution of hydrophobic dimethyldodecyl ammonium is held at hydrophobic substitution < 0.01. Four hydrophobic levels were tested with designations SL-5, SL-30, SL-60, and SL-100, where the molar substitution of relative hydrophobe increases with increasing number from 5 to 100. The results indicate the addition of even low concentrations of hydrophobe leads to significant differences in performance.

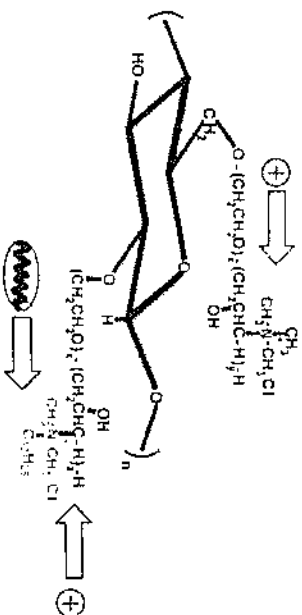


Figure 6. Polyquaternium 67: cationic HEC containing Hydrophobic substitution < 0.01 dimethyldodecyl ammonium.

A significant increase in wet combing performance is seen in shampoos formulated with hydrophobically modified polymers. This performance

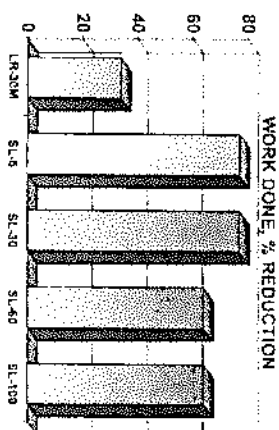


Figure 7. Wet combing force reduction of single bleached European brown hair using hydrophobically modified cationic HEC polymers. 15.2% SLES-2/2.56% DSCADA/0.3% polymer.

enhancement does not continue to increase with higher levels of hydrophobic substitution (SL-60 and SL-100) suggesting performance differences are not due to molecular weight effects, but to the hydrophobe itself. (Figure 7)

Silicone deposition onto hair is shown in Figure 8. Similar to wet combing data, silicone deposition increases in the presence on hydrophobe. Given the low level of hydrophobe, there is not a significant increase in molecular weight of these polymers. The near doubling of silicone deposition cannot be explained by simple increased flocculation and bridging caused by a larger polymer. It is more likely the hydrophobe is changing the interaction of the polymer with the surfactant and polymer with silicone.

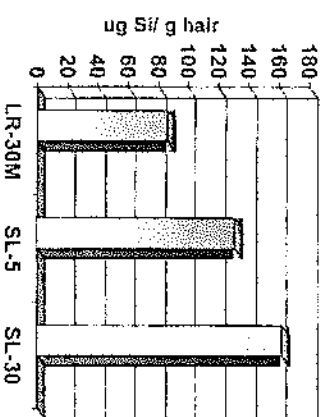


Figure 8. Silicone deposition on European brown hair of hydrophobically modified cationic HEC polymers. 15.2% SLES-2/2.56% DSCADA/0.3% polymer/0.25% polymer/1% dimethicone blend.

PQ67 polymers were also investigated in body wash systems (11% SLES-2, 4% CAPB, 15% sunflower seed oil, and 0.5% polymer). These polymers use the designation SK. The SK polymers tested vary charge substitution rather than hydrophobic density level (Figure 9). The effect of molecular weight on deposition of sunflower seed oil onto *Vitro*-skin is shown in Figure 10 using commercial PQ10 polymers. As with silicone deposition on hair, higher molecular weight polymer of either low or high charge density (LR and JR polymers, respectively) exhibits higher sunflower seed oil deposition. This increase in deposition may be related to large polymer bridging effects. Figure 10 also shows the effect of charge substitution on deposition. The higher charged JR30M (~1.7% N) deposits more oil than the lower charged LR30M (~1.0% N).

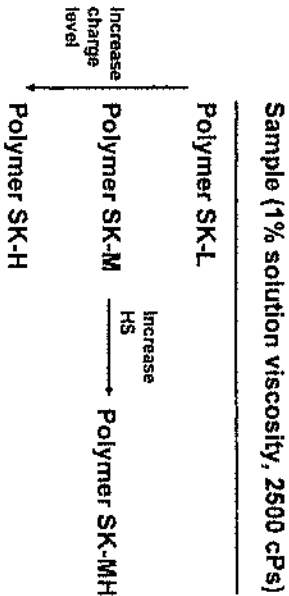


Figure 9. SK polymers used in body wash formulations. Hydrophobe density for SK-L, SK-M, & SK-H similar to SL-5; SK-MH similar to SL-30.

Additional charge substitution effects for SSO deposition are shown in Figure 11. In the presence of hydrophobe, rather than simply increasing with increasing charge, deposition actually peaks between LR30M (1.0% N) and JR30M (1.7% N).

As predicted from the low EO substitution studies and the results above, the presence of hydrophobe shifts coacervate curves significantly (Figure 12). The peak coacervate formed with SK-M (1.25% nitrogen) corresponds to peak coacervate formed with JR30M (1.75% nitrogen). The addition of hydrophobe shifted the peak coacervate to early dilution, leading to increased deposition. A similar peak shift is seen with SK-L (1.05% nitrogen) compared with essentially the same nitrogen level of LR-30M (0.95% nitrogen). The only difference being the presence of hydrophobe on SK-L. Both SK polymers show significantly broader coacervate curves, therefore accounting for the improved wet combing as well. This non linear effect of charge and hydrophobe substitution suggests

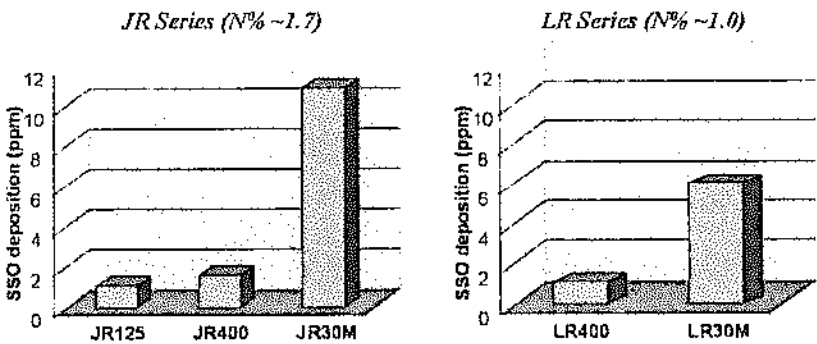


Figure 10. Molecular weight effects of sunflower seed oil deposition on Vitro skin: 11% SLES-2, 4% CAPB, 15% sunflower seed oil, 0.5% polymer. (MW: 125<400<30M. Charge: LR~1.0%, JR ~1.7%)

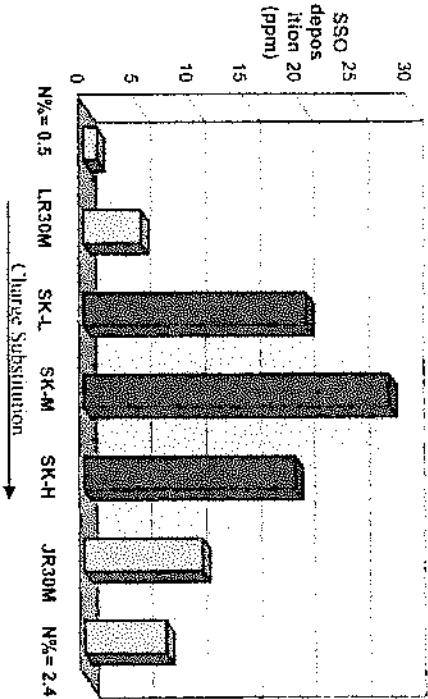


Figure 11. Effect of charge density in the presence of hydrophobe on surfloer seed oil deposition on in Viro skin. 11% SLES-2, 4% CAPB, 15% sunflower seed oil, 0.5% polymer (SK-L, 1.05%N; SK-M, 1.25%N; SK-H, 1.45% N)

specific structure/function relationships on the interaction of the polymer and surfactant which influence overall formulation performance.

Conclusion

The cationic HEC polymer architecture was found to have a significant effect on the formation and dissolution of surfactant-polymer coacervates, which were shown to be critical in deposition of water insoluble actives from shampoos and body wash formulations. A new compositional variant of cationic HEC polymers was synthesized by adding low levels of hydrophobic substitution (dodecyl chain). These hydrophobic chains had a pronounced affect on the deposition of insoluble actives presumably by associating with the surfactants through hydrophobic interaction, altering the interactions, and affecting overall formulation performance. The coacervate curves shifted significantly to the left (lower dilution) while continuing over a broad zone. With the addition of low levels of hydrophobic substitution, significant improvement in coacervate formation, and silicone and sunflower seed oil deposition were achieved. The data also reveal that coacervate curves can be used to predict overall polymer performance in rinse off systems.

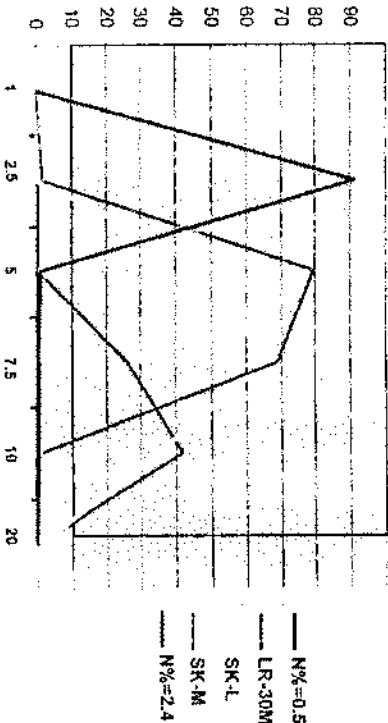


Figure 12. Coacervate haze curves at different charge density measured using a haze meter. 11% SLES-2, 4% CAPB, 0.5% polymer. (See page 1 of color inserts.)

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