

**Dual functional anti-oxidant and SPF enhancing lignin-based copolymers as additives for personal and healthcare products**

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Figure S1  $^1\text{H}$  NMR (acetone- $\text{d}_6$ ) of lignin-Br

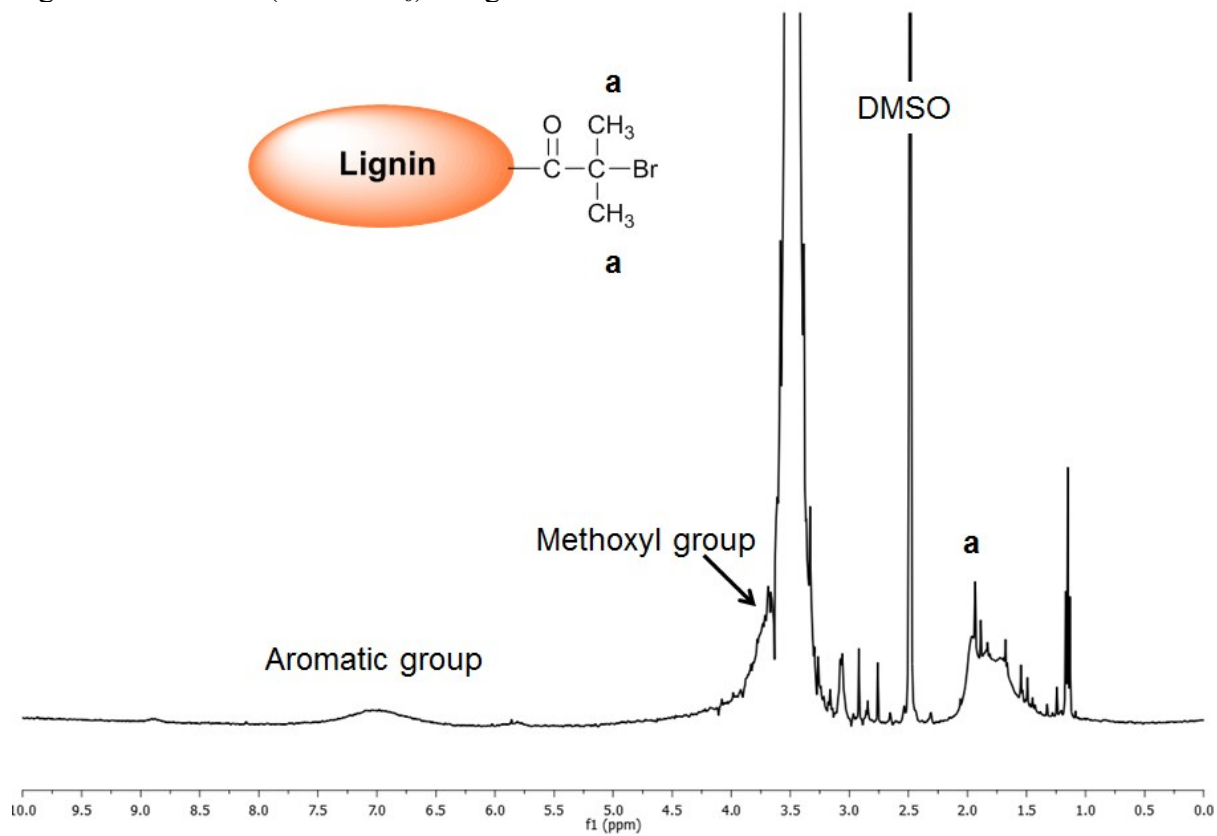
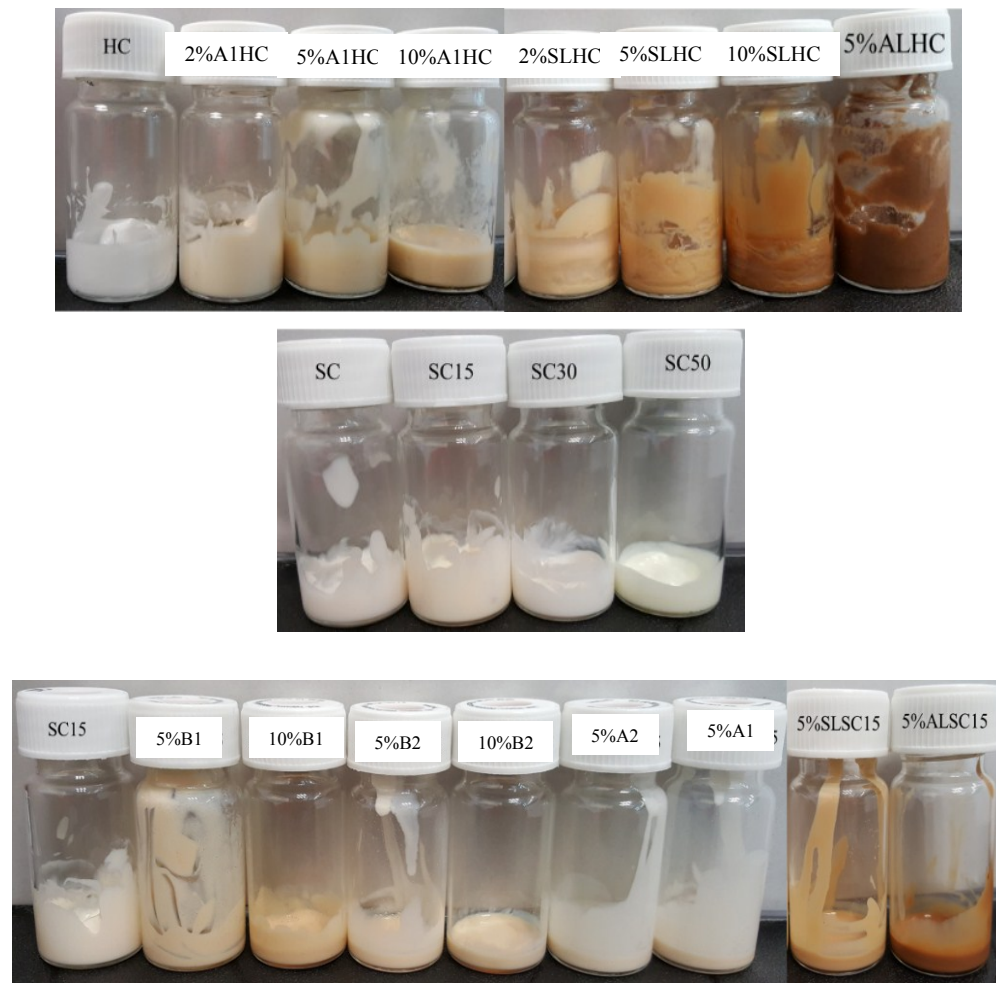


Figure S2



Ingredients:

**Shiseido White Lucent brightening protective cream SPF15**

Active Ingredients: Octinoxate 7.4%, Ensulizole 2.5%, Titanium Dioxide 1.9%

Water, Butylene Glycol, Glycerin, Dipropylene Glycol, Hydrogenated Polydecene, Pentaerythrityl Tetraethylhexanoate, Dimethicone, SD Alcohol 40B, Behenyl Alcohol, Polybutylene Glycol/PPG-9/1 Copolymer, Tranexamic Acid, Beheneth-20, Triethanolamine, Silica, Xanthan Gum, PEG/PPG-14/7 Dimethyl Ether, Erythritol, PEG/PPG-17/4 Dimethyl Ether, 2-O-Ethyl Ascorbic Acid, Glucosyl Hesperidin, Phytosteryl/Octyldodecyl Lauroyl Glutamate, Sodium Hyaluronate, Stearyl Alcohol, Hydrogenated Palm Oil, Elaeis Guineensis (Palm) Kernel Oil, Elaeis Guineensis (Palm) Oil, Sodium Metaphosphate, Trisodium EDTA, Cellulose Gum, Aluminum Hydroxide, BHT, Sodium Metabisulfite, Tocopherol, Citric Acid, Phenoxyethanol, Fragrance, Iron Oxides

**Shiseido Urban Environment UV protector extra mild SPF30**

Water, Discopropyl Sebacate, Octocrylene, Alcohol, Dipropylene Glycol, Triethylhexanoin, Glycerin, Xylitol, Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine, Butyl Methoxydibenzoylmethane, Diethylamino Hydroxybenzoyl Hexylbenzoate, Vp/Eicosene Copolymer, Behenic Acid, Behenyl Alcohol, Propylene Glycol Stearate Se, Peg-60 Glyceryl Isoesterate, Glyceryl Stearate Se, Batyl Alcohol, Phenoxyethanol, Triethanolamine, Xanthan Gum, Butylene Glycol, Fragrance (Parfum), Methyl Gluceth-10, Peg/Ppg-14/7 Dimethyl Ether, Polybutylene Glycol/Ppg-9/1 Copolymer, Trisodium Edta, Cellulose Gum, Magnesium Aluminum Silicate, Limonene, Linalool, Scutellaria Baicalensis Root Extract, Butylphenyl Methylpropional, Benzyl Benzoate, Hexyl Cinnamal, Citronellol, Eugenol, Geraniol, Arginine Hcl, Ectoin, Ononis Spinosa Root Extract, Syzygium Jambos Leaf Extract, Arginine Hcl, Sodium Pca, Tocopherol

**Shiseido Urban Environment UV protection cream plus SPF50**

Water, Discopropyl Sebacate, Octocrylene, Dipropylene Glycol, Triethylhexanoin, Polysilicone-15, Alcohol, Glycerin, Xylitol, Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine, Butyl Methoxydibenzoylmethane, Vp/Eicosene Copolymer, Diethylamino Hydroxybenzoyl Hexylbenzoate, Pentaerythrityl Tetraethylhexanoate, Behenic Acid, Behenyl Alcohol, Phenoxyethanol, Triethanolamine, Butylene Glycol, Fragrance (Parfum), Polybutylene Glycol/Ppg-9/1 Copolymer, Trisodium Edta, Methyl Gluceth-10, Peg/Ppg-14/7 Dimethyl Ether, Xanthan Gum, Cellulose Gum, Magnesium Aluminum Silicate, Limonene, Linalool, Scutellaria Baicalensis Root Extract, Butylphenyl Methylpropional, Benzyl Benzoate, Hexyl Cinnamal, Citronellol, Eugenol, Geraniol, Syzygium Jambos Leaf Extract, Arginine Hcl, Ononis Spinosa Root Extract, Ectoin, Sodium Pca, Tocopherol