



Black Soldier Larvae Oil in cosmetic emulsions

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Introduction:

Black soldier fly larvae oil (BSFLO) is rich in lauric acid, and its fatty acid profile is similar to that of palm kernel oil and coconut oil. Therefore, it can be considered an alternative to these vegetable oils. More than 80% of world palm oil yields come from Malaysia and Indonesia, which has caused severe deforestation of equatorial and tropical rainforests. BSFLO is produced by pressing and drying the larval phase of the life cycle of the *Hermetia illucens* (Black soldier fly) of the family Stratiomyidae. Fly larvae feed on biological waste, which they successfully process, so ecologically clean circular oil production is realized. Few attempts have been made to use insect oil to produce value-added products. Fats and oils are commonly used in cosmetics, which are a major component of skin care creams.

Our work aims at presenting exemplary formulations of a cosmetic product hand cream, containing purified BSFLO. We successfully applied a purification procedure consisting of five stages (degumming, dehumidification, neutralization, bleaching, deodorization) for BSFLO to obtain a lighter and clearer oil suitable for inclusion in cosmetic products. NMR characterization of the oil before and after the purification showed no change in the fatty acid profile. Cosmetic cream formulations were prepared with purified and non-purified oil, and their properties were compared to formulations with palm kernel (PKO) or coconut oil (CO). Good quality products with purified BSFLO were obtained, resembling those with palm kernel or coconut oil.

Materials & Methods:

Crude larvae oil purification - in five stages: degumming, dehumidification, neutralization, bleaching, and deodorization.



Cosmetic cream formulation and characterization

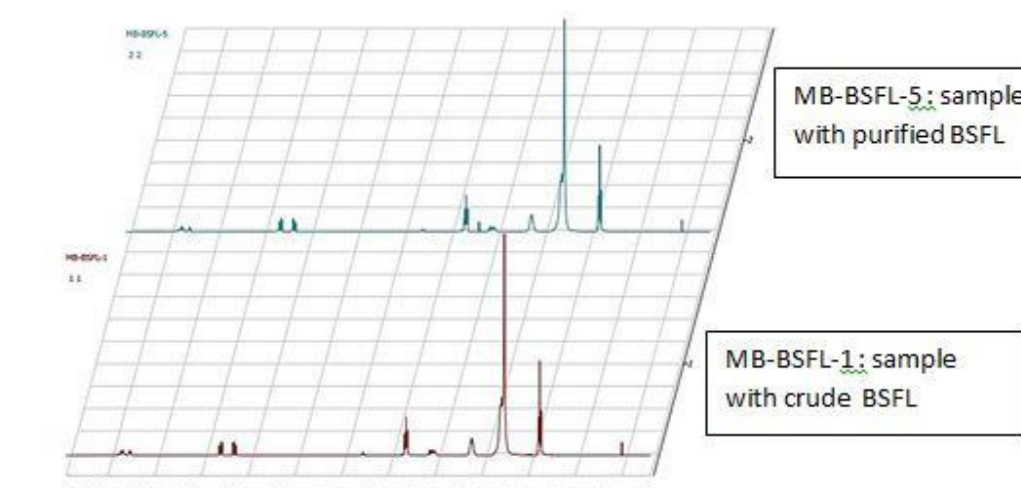
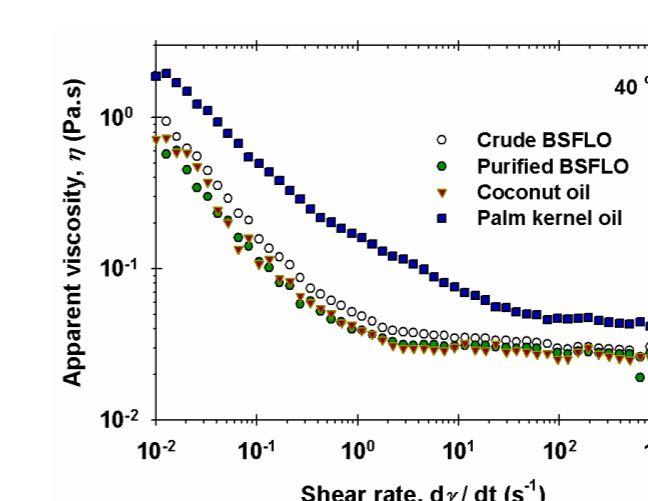
Main emulsification: Ultra-Turrax, 8000 rpm for 5 min at 75-80 °C;
Optical microscopy, Rheology, stability upon heating, freezing and centrifugation



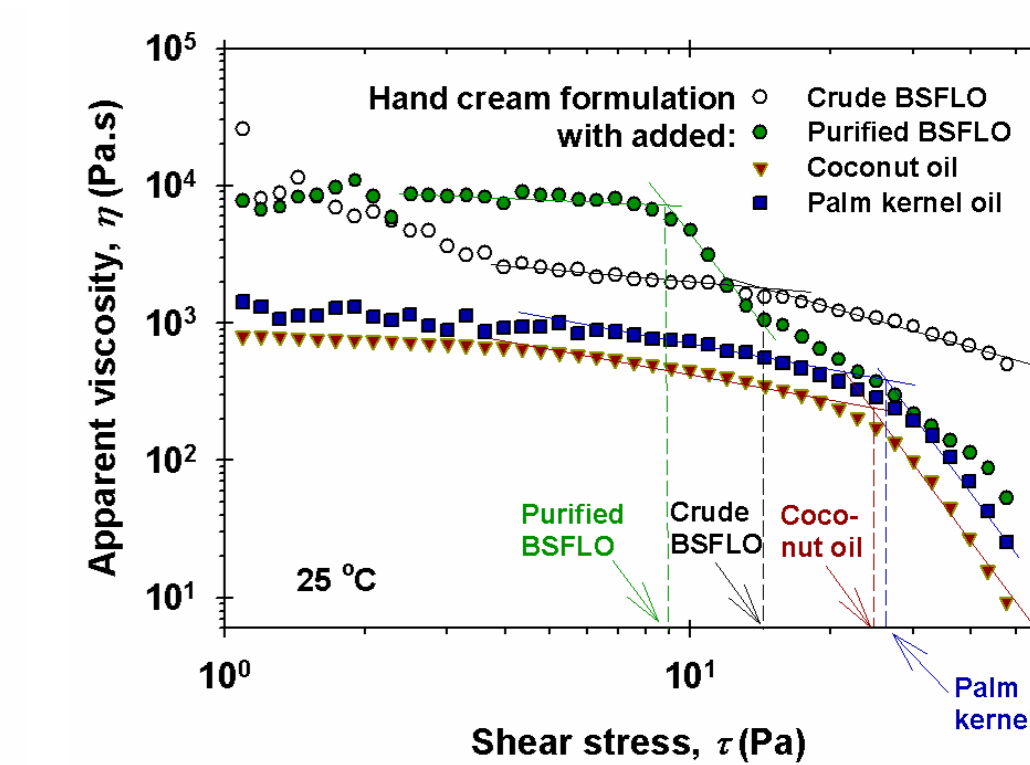
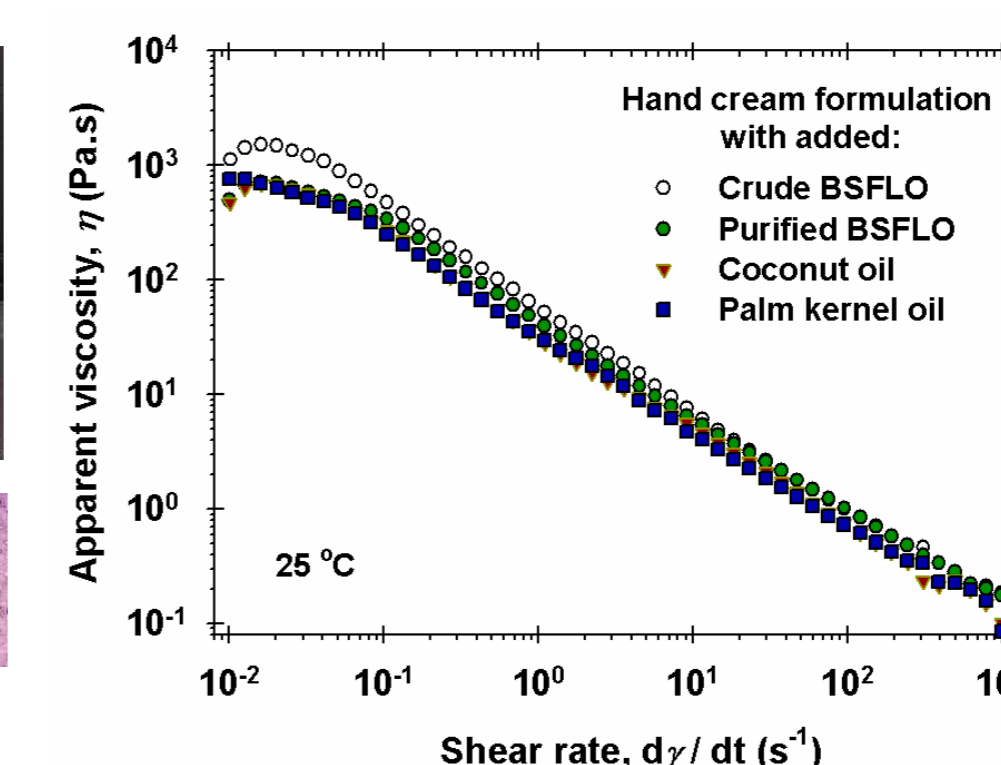
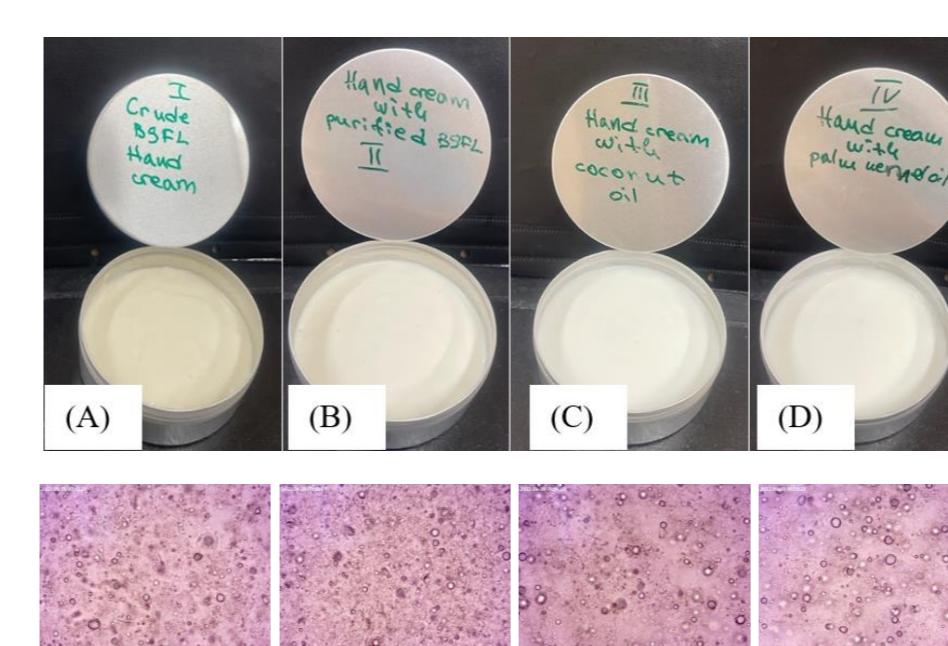
	Ingredient	I - with Crude BSFLO	II - with Refined BSFLO	III - with CO	IV - with PKO
A - oil phase 25 %	Crude BSFL OIL	7			
	Refined BSFL OIL		7		
	Coconut oil			7	
	Palm kernel oil				7
	Olive oil	4	4	4	4
	Shea butter	2.5	2.5	2.5	2.5
	Steareth 20	3	3	3	3
	PEG -400	2	2	2	2
	Caprylic/Capric Triglycerides	1	1	1	1
	Cetyl alcohol	2	2	2	2
Stearic acid	3	3	3	3	
Vitamin E	0,5	0,5	0,5	0,5	
Glycerin	3	3	3	3	
B - aqueous phase 75%	Xantan gum	0.5	0.5	0.5	0.5
	Propylene glycol	0.5	0.5	0.5	0.5
	Distilled water	70.1	70.1	70.1	70.1
	Allantoin	0.2	0.2	0.2	0.2
	Pro vitamin B5	0.5	0.5	0.5	0.5
Methyl paraben	0.2	0.2	0.2	0.2	
C	Perfume	q.s	q.s	q.s	q.s
	Lactic acid	q.s	q.s	q.s	q.s

Results & Discussion:

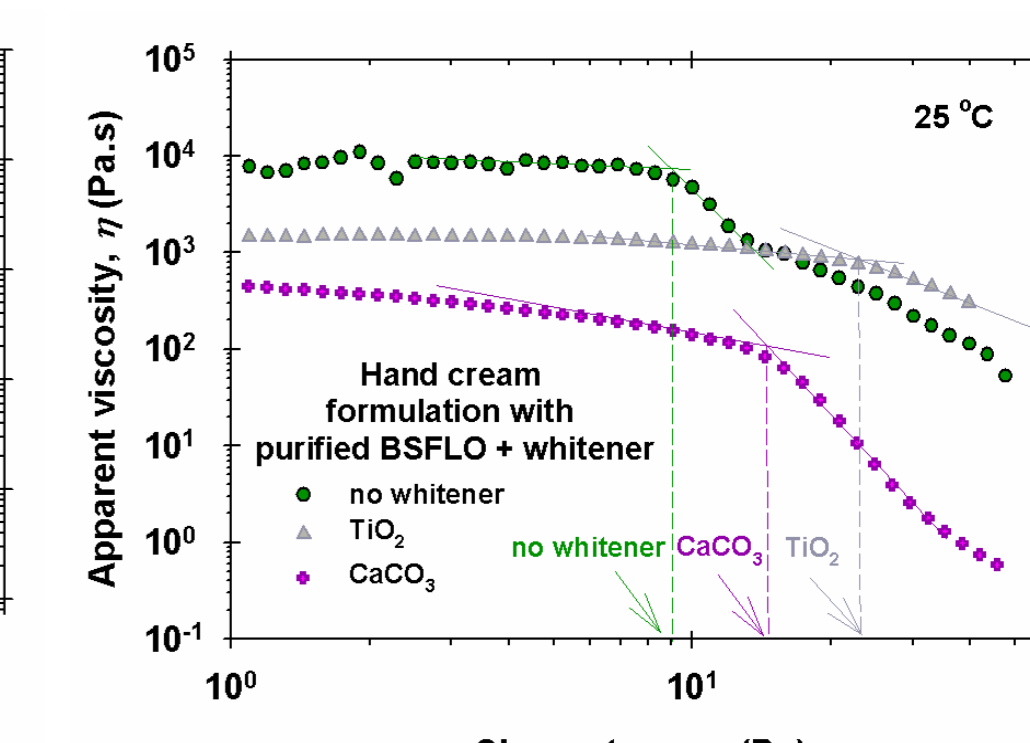
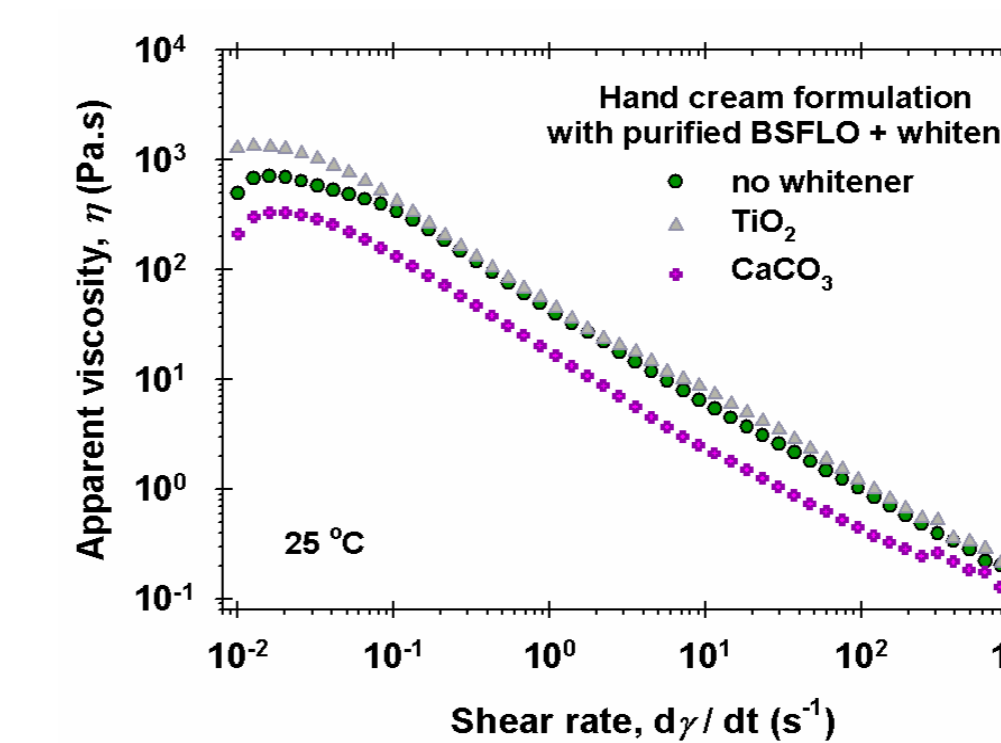
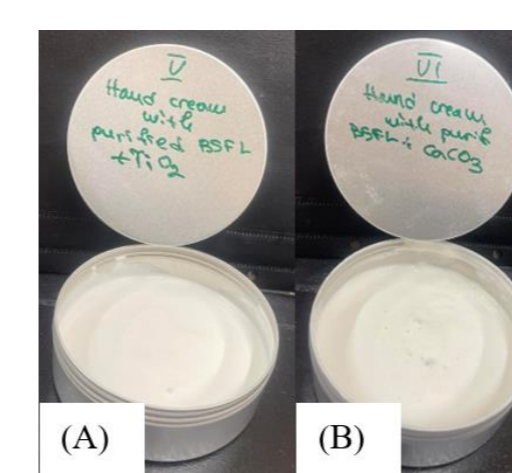
The refined BSFLO is more transparent, lighter in color, 10% less viscous, almost odorless, but with the same fatty acid content as the crude oil.



The cream formulations with the crude BSFLO were yellow in color and with a characteristic oil smell. The prepared hand cream emulsions with the purified BSFLO had the viscosity, yield stress, stability, color and odor as those with coconut or palm kernel oil.



The cream was successfully whitened with small amount of white pigment. The inclusion of 2 wt% pigments did not lead to qualitative changes of the flow properties and the stability.



Conclusions:

Black fly soldier oil is a promising natural resource with tremendous potential for future development. Our study showed that model cosmetic emulsions (hand cream) with purified BSFLO had very similar properties (viscosity, relative size of oil droplets, stability to storage at different temperatures, and centrifugation at high speeds) compared to emulsions containing coconut or palm kernel oil. The applied five stage purification significantly improved the color and the odor of the oil, which resulted in almost odorless emulsions with very light yellow color. The light coloring was successfully removed by using white pigments. The formulated creams with the purified BSFLO and titanium dioxide had color, gloss, and yield stress as those of the creams with the coconut oil and palm kernel oil.

Future toxicological assessment would allow faster inclusion of the oil BSFLO as a cosmetic ingredient which could successfully replace coconut or palm kernel oil in many applications.

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