Application of optimized low-energy emulsification technology in cosmetics

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Introduction:

With the enhancement of consumers' environmental awareness, green cosmetics have become an important development trend. The "green" concept is not only reflected in natural materials, sustainable packaging, but also in the manufacturing process of products. Therefore, in the process of cosmetics production, we should reduce energy consumption to promote the development of environment friendly society. The amount of energy expended in the traditional cosmetic emulsification process is far greater than the amount theoretically required, and the cooling stage is inefficient. Moreover, the low energy emulsification (LEE) technology proposed by T.J.Lin (Lin Joseph) is not completely applicable to the current technology and equipment, so we optimized the LEE and applied it to the production of cosmetic creams. In addition to conserving energy, reducing processing time, the optimized LEE also offers great advantages in reducing product particle size and improving product quality.

Materials & Methods:

The materials used in this experiment are shown in Table1.

The methodology used to perform the work is shown in Fig.2

Table1 The formula composition of O/W cream

	INCI Name	wt%
Oil Phase	BUTYROSPERMUM PARKII (SHEA BUTTER)	2~4
	DIMETHICONE	1~2
	CETEARYL ALCOHOL/CETEARYL GLUCOSIDE	2~4
	CETEARYL ALCOHOL	2~4
	HYDROGENATED POLYDECENE	2~4
	CAPRYLIC/CAPRIC TRIGLYCERIDE	1~4
Hot Water Phase	ACRYLATES/C10-30 ALKYL ACRYLATE CROSSPOLYMER	0.1~0.3
	PENTYLENE GLYCOL	2~5
	60% HOT WATER	43.32~52.44
Cold Water Phase	CAPRYLYL GLYCOL、1,2-HEXANEDIOL	0.5
	40% COLD WATER	28.88~34.96

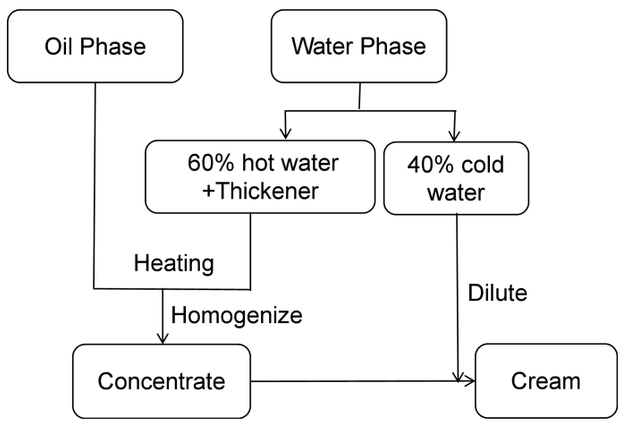

Fig.1 Optimized energy-saving process

Table2 Evaluation criteria of cream

Evaluation stage	Indicators	Definitions	Score
Before applying	Gloss	The ability of the surface of the cream to reflect light when exposed to light. The higher the score, the better the gloss	1-7
	Smoothness	The degree of smoothness and uniformity of the cream surface, the higher the score, the smoother	1-7
	Viscosity	Test the viscosity of the sample, the higher the score, the greater the viscosity	1-7
Smearing	Spreadability	The higher the score, the easier it is to spread the test sample	1-7
	Absorption rate	Test the absorption rate of the sample, the higher the score, the faster the absorption	1-7
After applying	Residue	The cream that remains on the skin after the application, the higher the score, the less the residual amount	1-7
	Preference	The preference of the test sample, the higher the score, the higher the preference	1-7

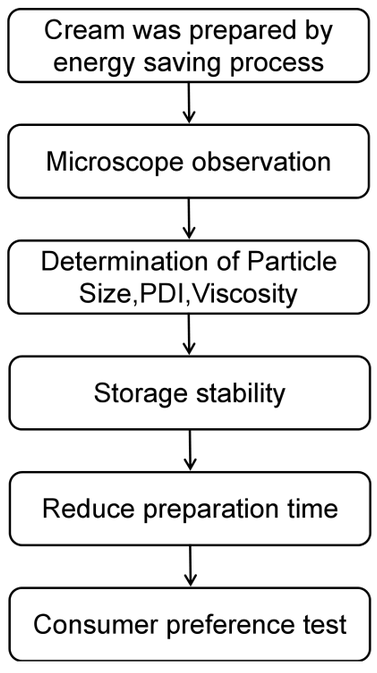

Fig.2 Method diagram for this article

Results & Discussion:

Compared with the traditional process, the viscosity of cream produced by the optimized LEE technology was higher : it increased from 144000MPa·s to 214500MPa·s under the same measurement conditions. The particle size reduced from 932.4±6.29nm to 744.6±8.91nm, and the PDI decreased from 0.170±0.025 to 0.145±0.030. The thermal energy and water resources usually wasted in the processing of cosmetic creams can be saved by using the optimized LEE technology, and the cooling time can be shortened by 27.27%. The cream produced by the energy-saving process has a smaller particle size, better gloss and smoothness, and a faster absorption rate, and is more popular with consumers.

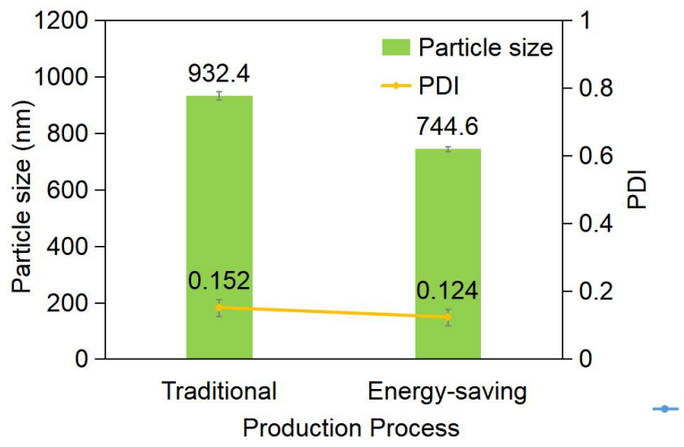

Fig.3 Particle size,PDI

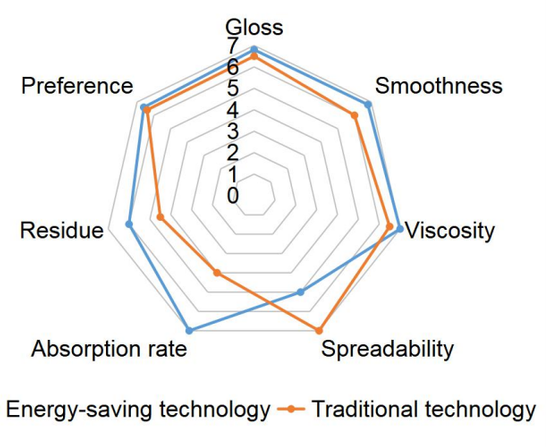

Fig.4 Subjective evaluation results

Operation	Traditional production time	Energy-saving production time
Preparation	50 min	50 min
Heating	30 min	25 min
Homogenizing	10 min	10 min
Cooling	75 min	35 min
Total	165 min	120 min
Reduced time		27.27%

Table3 Processing Time

Conclusions:

In this paper, the key parameters of the optimized low-energy emulsification process (energy saving process) were explored, and the scale-up production was successfully completed. By applying thermal and mechanical energy more specifically to the emulsification process, the optimized LEE process can save energy and improve production efficiency, reflecting the green advantages of the product manufacturing process. And only 60% of the water is involved in the emulsification, which increases the mechanical energy per unit weight compared to traditional processes, resulting in smaller particle size of the cream, more delicate skin feeling and better gloss, which is more favored by consumers.

Aknowledgments:

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