The Development of a Shower Gel Contained the Crude Extracts of Oat

Xiao Zhang, Qing Ren(Ph. D）

Beijing Technology and Business University; Beijing Higher Institution Engineering Research Center of Food Additives and Ingredients

Contents

- Introduction of Skin Cleaning
- The composition of shower gel
- The skin care effect of Oats crude extracts
- The Development of a Shower Gel
  - The process optimization of extracting of oat active substances;
  - The moisturizing properties and safety evaluation of oats active substances;
  - The design of shower gel basic formulation;
  - The amount of oat active substances in shower gel.
- Conclusion

1. Introduction of Skin Cleaning

Human skin is the natural barrier of body, particularly for the appearance of body. In the normal physiological, the sebaceous glands secrete sebum attached to the skin surface, forming a thin layer to keep the skin soft and smooth.

sweat which include salt, urea and protein degradation products

dead cells after skin peeling off

the dust in the air which attach to the skin surface

the growth of bacteria and air oxidative rancidity

The dirt on the skin

Therefore, cleaning the skin is essential to ensure the health of the skin and maintain beautiful appearance.

2.The prescription composition of shower gel

Major components	Function
surfactant	the most important ingredients, which can generate bubble, wet the skin, emulsify to remove dirt and grease in order to clean the skin
humectant	prevent the problem of degrease，give the skin lipid, moisture and gloss，relieve irritancy
active substance	prevent skin dry to improve refreshing smooth feeling， a kind of natural plant additive which has the effect of skin care
preservatives, flavors and pearlescent agents	improve the overall quality of the product

2.The prescription composition of shower gel

Tab 1. The role of major raw materials in shower gel

RAW MATERIALS	INCI NAME	FUNCTION
AES	Fattyalcohol polyoxyethylene ether,sodium sulfate	It is a kind of anionic surfactant with well detergency, good emulsifying power, high foaming ,good thickening and well compatibility.
B-750D	Na salt of mono alkyl phosphate	It is a kind of anionic surfactant with good foaming properties and well detergency.
CAB	Cocamidopropyl betaine	It is a kind of amphoteric surfactant with obviously high cleaning power and aiding foaming effect.
6501	Coconut fatty acid	It is a kind of foam stabilizer which possesses good wetting properties and good thickening powers.
C-14s	Guar gum	thickening
1,3- Butanediol	1,3- Butanediol	excellent moisture retention

2.The prescription composition of shower gel

Tab 1. The role of major raw materials in shower gel

RAW MATERIALS	INCI NAME	FUNCTION
Glycerol	Glycerol	hydrating
Polyquaternium-7	Polyquaternium-7	providing silky skin feel
Pearly-lustre	Ethylene glycol distearate //Coconut Monoethanol Amide//Sodium lauryl sulfate//ethylene glycol distearate//Sodium Lauryl Ether Sulfate Cocamidopropyl	improving the cream color
Citric acid	citric acid	role of neutralization
Preservative	preservative	preventing oxidative damage
Essence	Essence	perfume

3. The skin care effect of Oat crude extracts

Oat crude extracts contain **polysaccharides, protein, allergy anti-itch ingredients** and many other active skincare ingredients.

polysaccharides --- moisture locking and skin repair effects

small molecule protein--- absorbed by skin and participate in the skin metabolism

macromolecular protein--- demonstrate good film-forming property and make skin slippery

4. The Development of a Oats Shower Gel

4.1 The process optimization of extracting of oat active substances

Investigated by **ratio of material and solvent, temperature, pH** and **time**, with extract rate of **protein and β-glucan** as index ,and the process was optimized by orthogonal test.

4. The Development of a Oats Shower Gel

4.1 The process optimization of extracting of oat active substances

(1) The influence of single factor on crude extracts of oat active substances

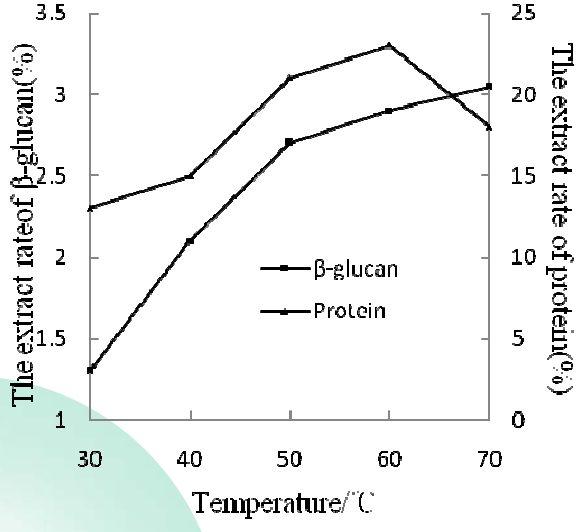


Figure 1 The effect of temperature on the rate of oat crude extract

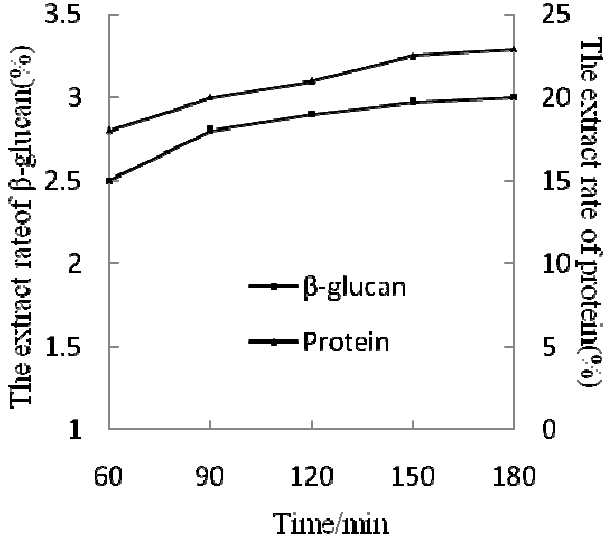


Figure 2 The effect of time on the rate of oat crude extract

4. The Development of a Oats Shower Gel

4.1 The process optimization of extracting of oat active substances

（1）The influence of single factors on crude extracts of oat active substances

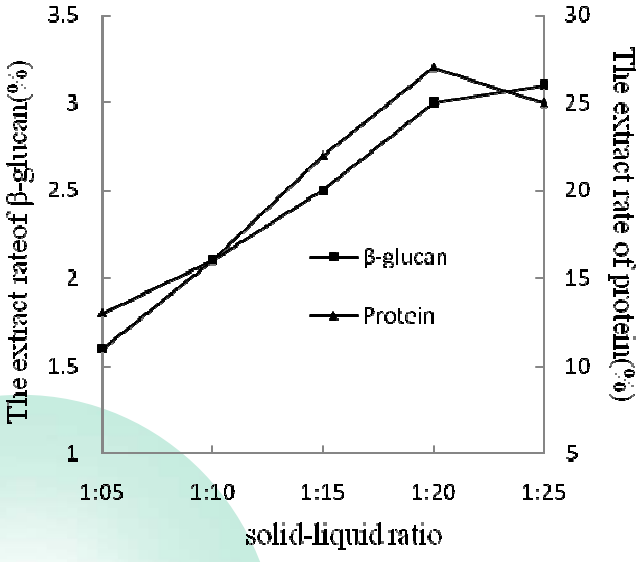


Figure 3 The effect of ratio material and solvent on the rate of oat crude extract

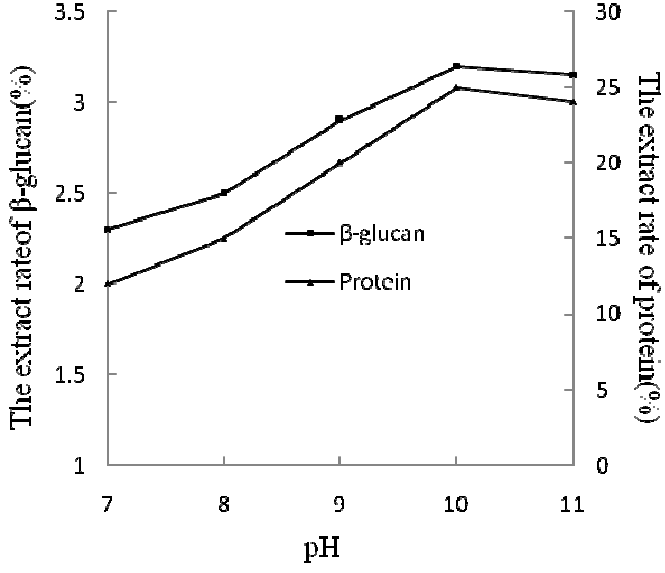


Figure 4 The effect of pH on the rate of oat crude extract

4. The Development of a Oats Shower Gel

4.1 The process optimization of extracting of oat active substances

(2) Process optimization of oat crude extracts and its optimal level of selection

Tab2. The results in an orthogonal design of oats crude extracts

Factors	Solid/Liquid Ratio	pH	Temperature	Time
Test 1	1	1	1	1
Test 2	1	2	2	2
Test 3	1	3	3	3
Test4	2	1	2	3
Test 5	2	2	3	1
Test 6	2	2	1	2
Test 7	3	1	3	2
Test 8	3	2	1	3
Test 9	3	3	2	1
The mean 1	2.83	2.397	2.793	2.797
The mean 2	2.85	2.833	2.897	2.897
The mean 3	2.817	3.267	2.807	2.803
Range	0.033	0.87	0.104	0.1

4. The Development of a Oats Shower Gel

4.1 The process optimization of extracting of oat active substances

（2） Process optimization of oat crude extracts and its optimal level of selection

Tab3. Analysis of Variance Models in Orthogonal Designs

Factors	Sum of squared deviations	Degrees of freedom	F-ratio	F critical value	Significance
Solid/Liquid Ratio	0.002	2	0.105	19	
pH	1.135	2	59.737	19	*
Temperature	0.019	2	1	19	
Time	0.019	2	1	19	
Errors	0.02	2			

In conclusion, the results of optimum parameters of extracting oat crude substances were as follows: extracting for**1:20 of the ration material and solvent, pH=11, temperature of 60 ℃** and **time 150min**. The extraction rate of glucan and protein were 3.34% and 32% respectively. 100 mL of extract contained 15mg glucan and 0.256g protein.

Total solids content was 6.4%, and the conductivity was 397.

4. The Development of a Oats Shower Gel

4.2 The moisturizing properties and safety evaluation of oat active substances

Skin moisture measurement value(MMV) test

Trans-epidermal water loss(TEWL) measurement

Evaluation of skin irritation -- human red blood cell(RBC) hemolysis test

The evaluation of anti-allergic properties --the inhibition of hyaluronidase in vitro

Corneometer

Tewameter

4. The Development of a Oats Shower Gel

4.2 The moisturizing properties and safety evaluation of oat active substances

（1）The result of MMV and TEWL test measurement for oat active substances

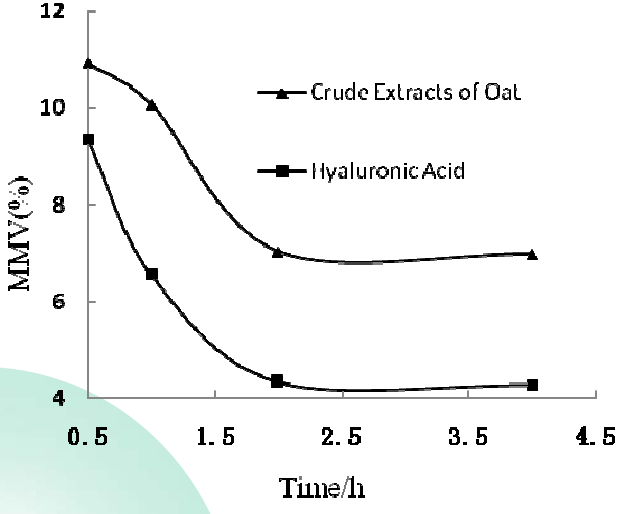


Figure 5 Incresement of MMV for moisturizing agent at different times

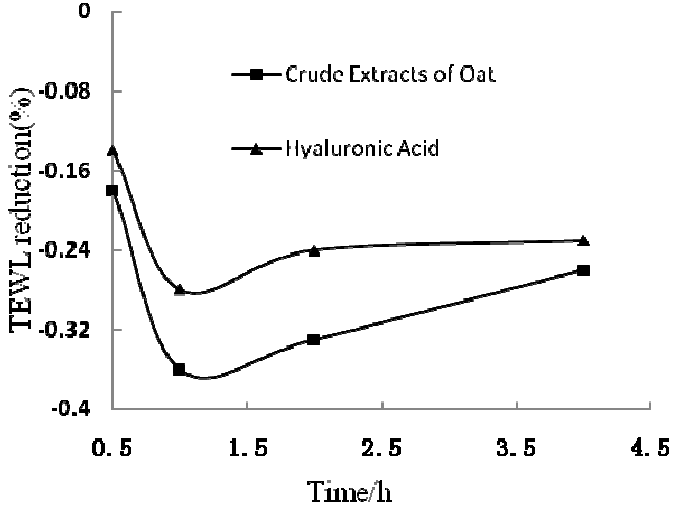


Figure 6 Reduction of TEWL for moisturizing agent at different times

Figure 5, 6 showed that oat crude extracts had good moisturizing effect and good locking water effect.

4. The Development of a Oats Shower Gel

4.2 The moisturizing properties and safety evaluation of oat active substances

（2）The result of RBC and the inhibition of hyaluronidase in vitro test for oat active substances

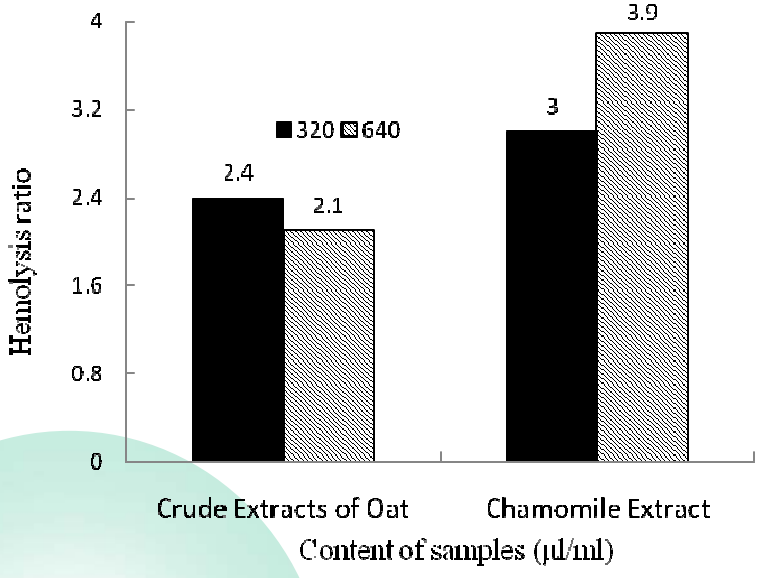


Figure 7 The results of skin irritation – human red blood cell(RBC) hemolysis test

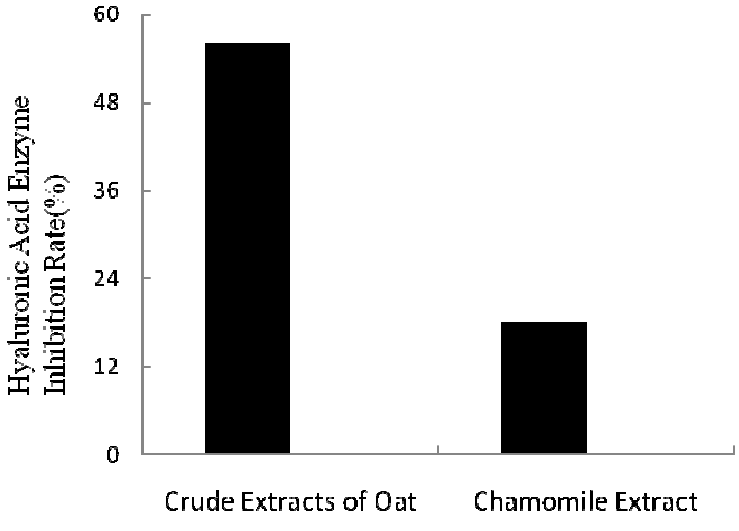


Figure 8 The results of anti-allergic properties – the inhibition of hyaluronidase in vitro

Figure 7, 8 showed that oats crude extracts was low in irritability and had good anti-allergic soothing effect.

4. The Development of a Oats Shower Gel

4.3 The design of shower gel basic formulation

Tab 4. Four formulations determined

RAW MATERIALS	Formulation 1	Formulation 2	Formulation 3	Formulation 4
AES	14	16	21	25
CAB	8	10	10	8
B-750D	4	5	4	5
6501	3	3	3	3
1,3-Butanediol	5	5	5	5
Glycerol	5	5	5	5
polyquaternium-7	2	2	2	2
Guar gum	0.2	0.2	0.2	0.2
citric acid	pH adjusted to 6.4	pH adjusted to 6.4	pH adjusted to 6.4	pH adjusted to 6.4
Pearling agent	2	2	2	2
Preservative	0.6	0.6	0.6	0.6
Essence	proper amount	proper amount	proper amount	proper amount
deionized water	To100	To100	To100	To100

Formulation is evaluated by product stability, foam height, the skin roughness and grease clearance with market selling shower gels as control.

4. The Development of a Oats Shower Gel

4.3 The design of shower gel basic formulation

Results of shower gel basic formulation evaluation

Tab 5. The stability of four formulations

Evaluation index	Formula 1	Formula 2	Formula 3	Formula 4	Market selling comparison
pH	6.4	6.4	6.4	6.4	8.17
40℃，24h	Pass	Pass	Pass	Pass	Pass
-5℃，24h	Pass	Pass	Pass	Pass	Pass
Month Circle 1 month	Pass	Pass	Pass	Pass	Pass
Mobility at 5℃	Qualified	Topnotch	Good	Qualified	Topnotch
foaming	Qualified	Topnotch	Topnotch	Topnotch	Good
skin roughness	Weaker	Weaker	Moderately	Obvious	Moderately
grease clearance（%）	67	78	79	84	73

The second basic formula was chosen for the product because of its good stability, rich foaming and moderate detergency in comparison with the market selling controls.

4. The Development of a Oats Shower Gel

4.4 The amount of oat active substances in shower gel

Two kinds of shower gels samples were made by adding **5%** oat crude extracts and **10%** oat crude extracts respectively to the determined above basic formulation.

The tested samples were analysed by **stability, hydration rate, TEWL lower rate** and **sensory evaluation**, with the market selling shower gels as control.

4. The Development of a Oats Shower Gel

4.4 The amount of oats active substances in shower gel

（1） The result of estimation of stability for shower gel

Tab 6. The stability of holistic shower gel

Evaluation index	Formula contained 5%oats crude extracts	Formula contained 10%oats crude extracts	Formula 2	Market selling comparison
pH	Pass	Pass	Pass	Pass
40℃，24h	Pass	Pass	Pass	Pass
-5℃，24h	Pass	Pass	Pass	Pass
Month Circle 1 month	Pass	Pass	Pass	Pass
Mobility at 5℃	Good	Topnotch	Good	Topnotch

4. The Development of a Oats Shower Gel

4.4 The amount of oats active substances in shower gel

（2）The result of MMV and TEWL test for shower gel

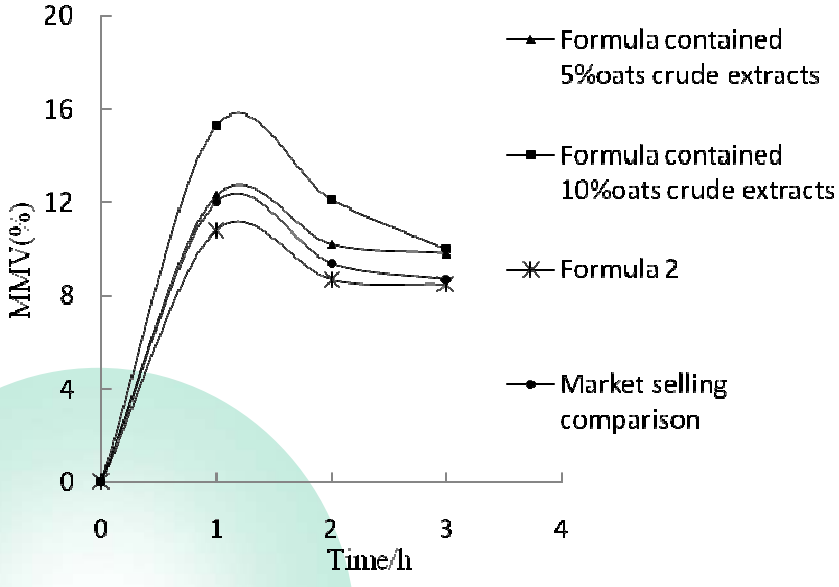


Figure 9 Incresement of MMV for holistic blend at different times

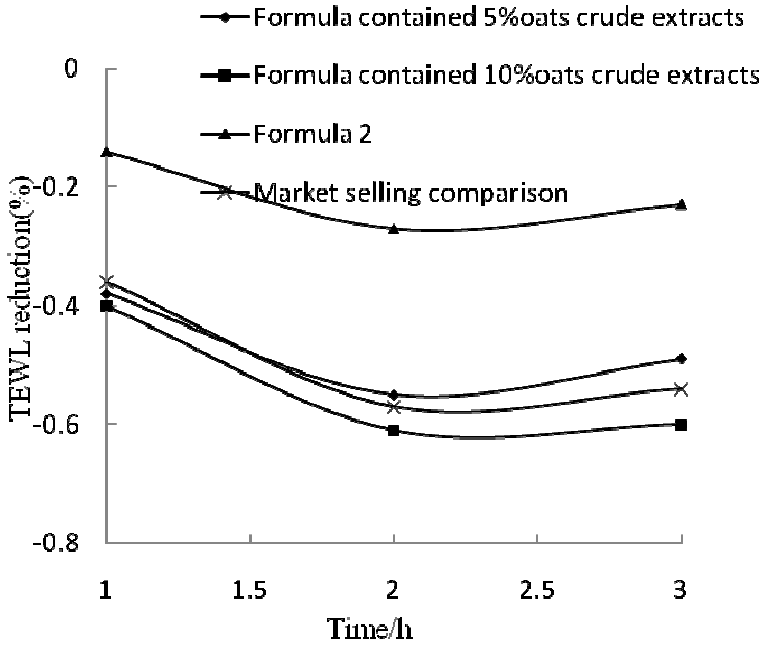


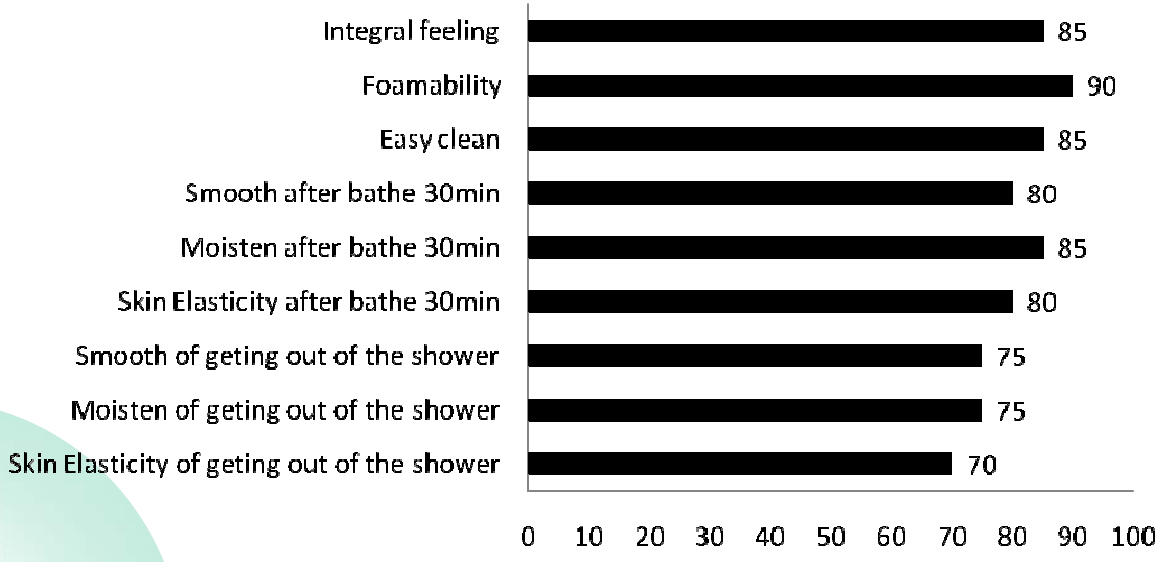
Figure 10 Reduction of TEWL for holistic blend at different times

4. The Development of a Oats Shower Gel

4.4 The amount of oats active substances in shower gel

（3）The result of sensory evaluation for oats shower gel

Tab7. The sensory evaluation results of shower gel



10% addition of oats crude extracts were finally determined for the production and the final formulation of the product was determined as formula 2 containing 10% oats crude extracts.

5. Conclusion

Tab 8.The final formulation of the product

RAW MATERIALS	PROPRIATE DOSAGE
AES	16
CAB	10
B-750D	5
6501	3
1,3-Butanediol	5
Glycerol	5
polyquaternium-7	2
Guar gum	0.2
citric acid	pH adjusted to 6.4
Pearling agent	2
Preservative	0.6
Essence	10% oats crude extracts
deionized water	To100

These series of oats skincare products producted by our team recently.

卓尔美
JOYME

Thank you!

This work was supported by research grant China Agriculture Research System.