

Sodium Pyrrolidone Carboxylic Acid As Moisturizing Agent

S.Bhise

Dept.of Cosmetic Technology, L.A.D.& Smt.R.P.College for Women,
Nagpur MH, India.

Corres.author: suchitamb@gmail.com

Abstract: Sodium pyrrolidone carboxylic acid is the sodium salts of 2 pyrrolidone 5 carboxylate, It is one of the major Natural Moisturing factor (NMF) found in human skin. It is documented that sodium pyrrolidone carboxylic acid (Na-PCA) is used in hair care & skin care products with great effectivity as it is water extracting skin component.

As Na-PCA is the Natural Moisturizing Agent, it gives suppleness, humectancy & moisturizing property .It is being water soluble,therefore an oil in water (O/W) cream base decided to develop.

Three formulae were developed in laboratory incorporating 2.5% & 5% of Na-PCA &7.5% glycerine.

Three cream prepared were further studied for its stability with reference to effect of temp.i.e. at Room Temp.-24-28⁰c,at oven 50⁰c, & at refrigerator 90⁰c, change in colour, odour, pH, globules size & viscosity.It was further decided to study the performance evaluation.

Key Words: Na-PCA, NMF, Moisturizing Agent.

1. Introduction:

By Kligman, "Moisturizer is defined as a topically applied substance or product that overcomes the signs& symptoms of dry skin".

Idson defined as ,"a Moisturizer,a substance that can favourably affect the feeling of dry skin ,by influencing the water content of stratum corneum"¹.

The approach to restoring water to dry skin has taken three different routes.

1.Occlusion

2.Humectancy

3.Restoration of deficient materials which may be combined.

The first approach,occlusion consists in reducing the rate of transepidermal water loss through old or damaged skin or in protecting otherwise healthy skin from the effect of a severely drying environment.

The second approach to the moisturizing problem is the use of humectants to attract water from the atmosphere, so supplementing the skin's water content.

The third & perhaps the most valuable approach to moisturization of skin is to determine the precise mechanism of the natural moisturization process to assess what has gone wrong with it in the case of dry skin & to replace any materials in which such research has shown damaged skin to be deficient².

Moisturizer's often contain lipids & humectants of low molecular weight, humectants such as urea ,glycerine, lactic acid, pyrrolidone carboxylic acid (PCA) and salts are absorb into the stratum cornium and their by attracting water, increase hydration³.

1.1 Natural Moisturizing Factor(NMF)

“A Group of water soluble hydrophilic substances known as the natural moisturizing factor (NMF)⁴.

Analysis of water soluble component of stratum corneum have indicated the presence of amino –acid lactic acid ,sugar and pyrrolidone carboxylic acid.The latter material is found in relatively large concentration in cornified skin.It has recently been shown that salts of this material are extremely ,hygroscopic, dissolving in their own water of hydrations.

At pH of stratum corneum (pH5) pyrrolidone carboxylic acid exists almost exclusively in the salt form. There result suggest that this material may represent one of the important natural Moisturizing agent for skin⁵.

Laden and spitzer proved that significant quantities of Na-2-pyrrolidone -5 carboxylate exist in the stratum.This compound is now commercially available for use in cosmetics⁶.

1.2 Composition of NMF

Amino acids	40%
PCA(Pyrrolidone carboxylic acid)	12%
Lactates	12%
Urea	7%
NH ₃ ,Uric acid, glucosamine, creatinine	1.5%
Citrates	0.5%
Na 5%, k 4%, Ca 1.5 %, Mg 1.5% , Po ₄ 0.5%	18.5 %
Sucrose, Organic acid, Peptides, Other aterials	8.5%

1.3 Pyrrolidone Carboxylic Acid(PCA) ;(C₅H₇N₀₃)

*Molecular wt 129.11*⁷

1.4 Sodium pyrrolidone carboxylic acid (NA- PCA);(C₅H₆NNa₀₃)

*Molecular wt 151.1*⁸

Na-PCA is one of the major natural moisturizing factors(NME) found in human skin.

It is the sodium salts of 2 Pyrrolidone-5-Carboxylate(Na-PCA) is manufactured by dehydration of glutamic acid and forms as odourless solid.

Sodium -2 Pyrrolidone-5-Carboxylate has been Patented as a humectant at concentration of 2 % or higher.

Water absorption ability of Sodium Pyrrolidone Carboxylate⁹

Compound	%Moisture intake(31%RH)	%Moisture intake(58%RH)
Pyrrolidone Carboxylic Acid	<1	<1
Sodium Pyrrolidone Carboxylic Acid	20	61
Glycerine	13	35

1.5 Uses of Sodium Pyrrolidone Carboxylate in Cosmetics¹⁰

- 1) Sodium -2-pyrrolidone-5-carboxylate is an important humectants component of NMF.
- 2) It is used in moisturizing dry flacky skin.
- 3) It demonstrates excellent hygroscopic & humectants effect & these properties have been achieved with a salt form.
- 4) Skin & hair care products,suncare,make-up,product are among the major application for Na-PCA.
- 5) It moisturizes &protects skin from wind,cold.

2. Materials & Methods

Three O/W formulation were developed in laboratory incorporating glycerine & sodium pyrrolidone carboxylic acid(Na-PCA).

2.1 Formulation Notation

A- Base formulation with 7.5% glycerine.

B- Formulation with 2.5% Na-PCA.

C- Formulation with 5.0% Na-PCA.

2.2 Stability study for Finished Product.

All the three samples prepared were subjected to accelerated test conditions & were kept at room temp 24-28 0c,in oven at 50 0c & in refrigerator at 5-8 0c.

Stability studies were carried out by accelerated stability test for 40 days.

2.3 Performance Evaluation

Ten volunteers were persuaded & then selected. Two cream samples were given to each volunteer one is control i.e. sample- A (7.5% glycerine)& other is sample-C(5% Na-PCA).Cream was applied twice a day on 3 cm.area of forehead.Sample A on right forehead &sample C on left forehead. sked to see & compare the effect of sample A & C after two hours upto 30 days.

3. Results & Discussion

- 1) Result of colour change indicate that at room temp.& at 50 0c the degree of colour change was inversely proportional to the concentration of sodium PCA, on refrigeration there was no change in colour.
- 2) Result of odour change indicate there was no significant odour change at refrigeration, very slight odour change at room temp. It was only at 50 0c, the odour showed marked change .
- 3) Result of pH change indicates that at room temp. & refrigeration there was only slightly increase in pH but at 50 0c (oven) decrease in pH was observed.
- 4) Result of viscosity change indicates that at refrigerator (9 0c) the viscosity change with time was directly proportional to time but at Room Temp. &Oven the viscosity was first increase & then decrease after 30 days.
- 5) Result of actual globule size change indicate globule size change with time at Room Temp., Oven, Refrigerator.

4. Conclusion

This research work was an attempt to see the possibility of preparing a moisturizing cream using Na-PCA. It could be concluded from the studies carried out that,

- 1) The moisturing property of Na-PCA is satisfactory at 5% .However at higher conc. may give enhance moisturization.
- 2) Extrapolating the results of accelerated stability it could be concluded that the modified formulation would not break before a period of 1 year.

5. References

1. Maision G.deNavarre,The Chemistry & manufacture of Cosmetics,Vol.III, Second edition,Page No.111.
2. J.B.Wilkinson,R.J.Moore,Harry' Cosmeticology,Edition.VII,Page no.-320-321.
3. Hongbo Zhai,preventing Irritant Dermatitis,Cosmetics & Toiletries magazine,Vol.113,No.10,October 1998,Page No.45-46.
4. Maision G.deNavarre,The Chemistry & manufacture of Cosmetics,Vol.III,Second edition,Page No. 143.

5. Maison G.deNavarre,The Chemistry & manufacture of Cosmetics, Vol.III, Second edition,Page No. 145.
6. Maison G.deNavarre,The Chemistry & manufacture of Cosmetics,Vol.III,Second edition,Page No. 401.
7. Martha Windholz,susan Budavari,The merck Index, An Encyclopedia of Chemicals, Drugs & Biologicals, Tenth edition,page no.1156-1157.
8. Martindale Editorial Staff,J.E.F. Reynolds, The extra pharmacopoeia,Twenty-eighth edition, The council of the pharmaceutical society of Great Britain,1982-1983,(13256),page no.1756.
9. Maison G.deNavarre,The Chemistry & manufacture of Cosmetics, Vol.III, Second edition,Page No.113-114.
10. Takeo.Mitsui,New Cosmetics Science,edition I,1997,page no.138.
