# Utilization Of Microcrystalline Cellulose Prepared From Rice Straw In Manufacture Of Low Fat Soft White Cheese.

Fatma Abdelfatah Mohamed Hassan,*Galal A.M. Nawar, Ali Kamal Enab, Faten Lotfi Seleet, Ashraf Gaber Mohamed

Dairy Science Department and *Green Chemistry Department, National Research Center, Dokki, Cairo, Egypt.
* fatmahassan98@yahoo.com

**Abstract:** Micro crystalline cellulose was prepared from rice straw. Different concentration of resultant Micro crystalline cellulose (% 0.1, 0.2, 0.3, 0.4, 0.5, 1) were used in manufacture of low fat soft white cheese. Organo lepticall and chemical properties of resultant cheese were studied fresh and during storage 5°c± 1° for 45 days .Results showed that low soft cheese manufactured by using 0.1 % microcrystalline cellulose had a good flavour , body and texture and appearance than control and gained higher score fresh and during storage 5°c± 1° than control . Treatment had a higher content of tyrosine and tryptophan and total volatile fatty acids and total carbonyl compounds than control. Treatment had a higher content of alanine acid whereas control had a higher content of aspartic acid. Glutamic acid recorded a high percentage either control or treatment than other acids. Microcrystalline cellulose at 0.1 % lead to increase cheese yield, improving body, texture, appearance and flavor.
[Fatma Abdelfatah Mohamed Hassan, Galal A.M. Nawar, Ali Kamal Enab, Faten Lotfi Seleet and Ashraf Gaber Mohamed. **Utilization Of Microcrystalline Cellulose Prepared From Rice Straw In Manufacture Of Low Fat Soft White Cheese.** Journal of American Science 2011;7(7):622-625]. (ISSN: 1545-1003). http://www.americanscience.org.

**Key words:** Cheese, Stabilizer, Microcrystalline cellulose.

## 1. Introduction

Microcrystalline cellulose is highly crystalline particulate cellulose by removing amorphous (fibrous cellulose) regions of a purify typically with a strong mineral acid such as hydrogen chloride. Microcrystalline cellulose is a naturally derived stabilizer, texture, reduced – fat salad dressings, numerous dairy products and bakery products. Several micro crystals are hinged together cellulose- micro fibril. Microcrystalline cellulose molecules is made up of a chain of (about 250 glucose molecules). Thus, microcrystalline cellulose was prepared via bio-chemical processing of rice straw according to [Galal et al., 2008]. Then, the obtained unbleached pulp was bleached and converted to its corresponding microcrystalline cellulose accordance to [Galal and Mohamed, 2009]. The aim of this work is utilization studying the feasibility of microcrystalline cellulose extracted from straw rice in manufacture of low soft white cheese and study the effect of microcrystalline cellulose on yield, organoleptically, chemically properties of resultant soft white cheese fresh and during cold storage at 5 ±1°C.

## 2. Materials and Methods

Milk: fresh buffalo's milk was obtained from the herd of faculty of Agriculture, Cairo University. The milk was skimmed by using a mechanical separator to 1.5%. Chymosin derived by fermentation (CDF) was obtained from dairy ingredients division, Pfizer Inc. Cairo, Egypt (3gm/100kg milk).

**Preparation of Microcrystalline cellulose:**

Via bio chemical processing of rice straw was done according to [Galal etal, 2008] then the obtained unbleached pulp was bleached and converted to its corresponding microcrystalline cellulose according to [Galal and Mohamed, 2009].

**Experimental procedure:**

**Preliminary Experiments**

The low soft white cheese was manufacture according to Fahmi and Sharara [1950] by using different concentrations of micro crystalline cellulose (0.1, 0.2, 0.3, 0.4, 0.5, and 1%) and the resultant cheese was analyzed for organoleptic properties. Results showed that 0.1% microcrystalline cellulose had gained a highest score for appearance, body and texture and flavor. So, 0.1% concentration was used in the manufacture of the cheese. The resultant cheese was analyzed chemically and organoleptically when fresh, 15, 30 and 45 days of storage at 5 ±1°C. Also the yield of resultant cheese was recorded.

**Sensory evaluation**

The organoleptic properties of low fat soft white cheese were evaluated by a regular scoring including the staff members about (20 persons) of Food and Dairy Department at the National Research Centre according to El-Koussy et al. [1966]. Statistical analyses: Statistical analyses were performed using

the GLM procedure with SAS (2004) software. LSD comparison procedure was used to compare the means. A probability to P <0.5 was used establish the statistical significance.

**Methods of analysis:**

Milk: Total solids determined according to JDF method [1982], fat content by Ling [1963], Total protein as described in IDF standard [1986], and titratable acidity as AOAC [1985] while pH value was determined using pH meter, type (Digital Meter M 41150) equipped with a combined glass electrode. Cheese: Total solid determined according to IDF method (1982), fat content by Ling [1963]. Total protein and soluble nitrogen as described in IDF stander [1986], titratable acidity as described in AOAC [1985]. Total volatile fatty acid was assessed according to Kos i Kowski [1966] and soluble tyrosine and tryptophan were measure spectroscopically according to Vakaleris and Price [1959]. Organoleptic properties of low fat soft cheese quality were evaluated by scoring panel from the staff members 20 persons) at the national research centre according to El-Koussy [1966].

**3. Results & Discussion:**

**Table (1)** show chemical composition of law soft white cheese made from skim buffaloes' milk and 0.1% microcrystalline cellulose during cold storage (5°±1°C) for 45 days. It was clear that total solids increased gradually during cold storage in both control and treatment. On the other hand treatment had high total solids than control either fresh or during cold storage (5°±1°C). This may be due to the effect of treatment; similar results were reported by Kebary et al [1998]. Moisture content of control and treatment decreased as storage period progressed which might be due to the loss of cheese water. Also fat had the same trend. Acidity was higher in control than treatment either fresh or during cold storage at (5°±1°C). Acidity gradually increased either control or treatment during cold storage (5°±1°C) till 45 days. Whereas pH took an opposite trend.

**Table (2)** indicated the tyrosine and tryptophan in soft white cheese made from skim buffalo's milk and 0.1% microcrystalline cellulose during cold storage (5°C±1°C). The soft white cheese which made from skim milk and 0.1% microcrystalline cellulose had higher content of tyrosine than control either fresh or during cold storage (5°±1°C) also tyrosine content was increased gradually until 45 days in both control and treatment. From the same table we notice that tryptophan took the same trend of tyrosine. It is higher in treatment than control and increased gradually during cold storage (5°±1°C) until 45 days. These result are in agreement to (Abd El-Gawad and Hassan)(2000)

**Table (3)** show the total volatile fatty acid in soft white cheese made from skim milk and 0.1% microcrystalline cellulose fresh and during cold storage (5°±1°C). It is clear that total volatile fatty acids in treatment are higher than control either fresh or during cold storage. Total volatile fatty acids increased gradually during cold storage until 45 days. The increase of total volatile fatty acids may be due to the hydrolysis of fat during storage.

The TVFA increased in all cheeses control and treatment as storage period progressed. These results are in agreement with (Badawi and Kebary, 1998).

**Table (4)** show organoleptic properties of soft white cheese made from skim milk (control) and from skim milk and 0.1% microcrystalline cellulose. It is clear that treatment had gained a highest score for flavor, body and texture and appearance. Control had gained 83 score while treatment had gained 91 score. On the other hand total scores of flavor, body & texture and appearance decrease during storage (5°±1°C) until 45 days as by [El-Koussy, 1966].

**Table (5)** illustrates the flavour development in white cheese made from low fat milk during storage. It is clear that treated sample which manufacture by using 0.1% microcrystalline cellulose had a highest content of free amino nitrogen (mg/ml of valine) fresh and after storage at (5°±1°C) for 45 days. On the other hand treated sample had a highest content of both total volatile fatty acids and total carbonyl compounds (**µ** mol/Kg cheese) either fresh or after storage at (5°±1°C) for 45 days .This may be due to the effect of microcrystalline cellulose. These results are in agreement [Badawi and Kebary 1998].

**Table (6)** show the free amino acids of white cheese made from low fat milk during storage. From this table we notice that aspartic acid had a highest content than other acids either fresh or after storage for 45 days whereas alanine had a highest content in fresh treatment sample and then decreased from 14.8% to 13.5% after storage at (5 ±1°C) for 45 days. α amino –butyric acid is the lowest content either fresh or after 45 days of storage (5 ±1°C). On the other hand this acid did not find in treated sample while valine, therionine, glycine, leucine had intermediate content. Glutamic acid recorded a high percentage either control or treatment fresh and after storage for 45 days, these results with agreement to Abd El-Gawad and Hassan F.A. M. [2000].

**Conclusion**

Using 0.1%Microcristaline cellulose is the best conclusion for preparing cheese. It is lead to increase cheese yield, improving the body, texture, appearance and flavour.

Table 1. Chemical composition of low fat soft white cheese manufactuer by using 0.1 % microcrystalline cellulose during cold storage (5±1˚C).

| Storage /days | TS | | fat | | lactose | | Ph | | Acidity | |
|---|---|---|---|---|---|---|---|---|---|---|
| | C | T | C | T | C | T | C | T | C | T |
| 0 | $39^{Bab}$ | $43^{Ab}$ | $3^{Bd}$ | $3.9^{Ad}$ | $12^{Ba}$ | $13^{Aa}$ | $5.68^{Ba}$ | $5.73^{Aa}$ | $0.35^{Ad}$ | $0.33^{Ad}$ |
| 15 | $40.6^{Bab}$ | $44.1^{Ab}$ | $3.6^{Bc}$ | $4.2^{Ac}$ | $11.2^{Bb}$ | $11.7^{Ab}$ | $5.6^{Aab}$ | $5.68^{Ab}$ | $0.41^{Ac}$ | $0.39^{Ac}$ |
| 30 | $41.7^{Ba}$ | $44.9^{Aab}$ | $4.1^{Bb}$ | $4.8^{Ad}$ | $9.8^{Ac}$ | $10.1^{Ac}$ | $5.45^{Abc}$ | $5.61^{Ab}$ | $0.53^{Ab}$ | $0.45^{Bb}$ |
| 45 | $42.1^{Ba}$ | $45.7^{Aa}$ | $4.8^{Ba}$ | $5.5^{Aa}$ | $7.1^{Ad}$ | $6.8^{Ad}$ | $5.2^{Ac}$ | $5.3c^{Ac}$ | $0.58^{Aa}$ | $0.51^{Ba}$ |

C: control, T: treatment.

Table 2.Tyrosine and Tryptophan in low fat soft white cheese manufactuer by using with 0.1 % microcrystalline cellulose during cold storage (5±1˚C).

| Storage/days | Tyrosine | | Tryptophan | |
|---|---|---|---|---|
| | C | T | C | T |
| 0 | $55.9^{Ad}$ | $58.2^{Ad}$ | $45.8^{Ad}$ | $46.1^{Ad}$ |
| 15 | $88.9^{Ac}$ | $90.7^{Ac}$ | $70.8^{Bc}$ | $86.9^{Ac}$ |
| 30 | $117.5^{Ab}$ | $120.3^{Ab}$ | $90.5^{Bb}$ | $131.0^{Ab}$ |
| 45 | $180.0^{Aa}$ | $223.7^{Aa}$ | $117.3^{Ba}$ | $244.0^{Aa}$ |

- Different superscript (a, b,…) at the same raw are significantly different ($P < 0.05$)

Table3.Total volatile Fatty acids (TVFA) in low fat soft white cheese manufacture by using 0.1 % microcrystalline cellulose during cold storage (5±1˚C).

| Storage/days | TVFA | |
|---|---|---|
| | C | T |
| 0 | 14.5 | 15.6 |
| 15 | 17.3 | 18.5 |
| 30 | 21.8 | 22.2 |
| 45 | 33.7 | 44.7 |

Table 4. Organoleptic properties of low fat soft white cheese manufactuer by using 0.1 % microcrystalline cellulose during cold storage (5±1˚C).

| | **C** | **T** |
|---|---|---|
| Flavor (50) | $40^{b}$ | $46^{a}$ |
| Body & Texture (40) | $35^{a}$ | $37^{a}$ |
| Appearance (10) | $8^{a}$ | $8^{a}$ |
| Total | $83^{b}$ | $91^{a}$ |

Table 5.Flavor development in low fat soft white cheese control and treatment with 0.1 % microcrystalline cellulose during cold storage(5±1˚C). .

| Storage days | C | | | T | | |
|---|---|---|---|---|---|---|
| | FAN | TVFA | T.Carbonyl | FAN | TVFA | T.Carbonyl |
| 0 | $54.03^{Bb}$ | $14.5^{Ab}$ | $67.7^{Bb}$ | $69.7^{Ab}$ | $15.6^{Ab}$ | $88.3^{Ab}$ |
| 45 | $89.0^{Aa}$ | $33.7^{Ba}$ | $211.4^{Ba}$ | $90.5^{Ba}$ | $44.7^{Aa}$ | $301.0^{Aa}$ |

FAN : Free Amino Nitrogen ( mg/ml of value ).
TVFA:Total Volatile fatty acids (ml of 0.1 N NaoH / 10 g cheese).
T.Carbonyl:Total carbonyl (µ mol / Kg cheese).

Table 6.Free amino acids of low fat soft white cheese control and treatment with 0.1 % microcrystalline cellulose during cold storage(5±1˚C).

| Amino acids | C | | T | |
|---|---|---|---|---|
| Storage days | 0 | 45 | 0 | 45 |
| Alanine | 13.9 | 11.0 | 14.8 | 13.5 |
| Valine | 5.1 | 2.07 | 6.3 | 6.0 |
| Therionin. | 3.51 | 2.97 | 2.7 | 2.83 |
| Clycin | 5.82 | 4.2 | 12.78 | 6.50 |
| Leucin. | 7.11 | 7.20 | 12.9 | 7.8 |
| Serin. | 7.5 | 00.00 | 4.88 | 7.79 |
| Gysteine | 11.2 | 9.0 | 9.3 | 14.5 |
| Aspartic. | 14.2 | 17.3 | 12.6 | 16.19 |
| Phenylalanin. | 13.99 | 10.81 | 10.3 | 13.75 |
| α amino-buytric acid | 3.4 | 0.9 | 00 | 00 |
| Glutamic | 14.3 | 9.7 | 13.5 | 10.9 |

**References**


Abd El-Gawad, M.A.M, 1998. Manufacture and properties of Mozzarella cheese from Buffaloe's Milk, phD.Thesis . Dac. of Agric. Cairo university, Egypt, p.103.

A.O.A.C., 1985. Association of official agriculture chemistrs,official Methods of Analysis, Washington D.C., 13th Ed.

Badawi, R.M. and K.M.K. Kebary, 1998.Influence of fat replacers on the Quality of low fat tallaga cheese, Cairo, Egypt. Egyptian conf. Dairy Sci. & techn. pp.347-365.

Berry, N.W. and Mckerrigan, A.A., 1958. Carbonyl compounds as a criterion of flavour deterioration in edible fats.

El –Koussy, L. A., 1966. Studies on softy cheese manufacture from pasteurized milk. Ph. D. Thesis, Ain Shams University, Cairo, p. 42.

Fahmi, A.H. and H.A Sharara, 1950. Studies on Egyptian Domiati cheese. J.Dairy res.17: 312-318.

Galal, A.M.Bawar and Mohamd, 2009. Preparations of Microcrystalline cellulose using solar energy, Egyptian patent no. 200901081.

Galal A.M.Nawar, Maha M.Ahmed and Walid El-Zawawy, 2008. Producting paper pulp from rice straw utilizing solar energy, Egyptian patent no.2008 030422.

Hickey,M.W; Van Leeuwen, H.; hillier, A.J. and Jaga, G.R, 1983. Amino acid accumulation in cheddar cheese manufactured from normal and ultra filtered milk. Australian J.Dairy Technol. September, 1118-123.

Interbational Dairy Federation (IDF), 1982. Cheeses and processed cheese determination of total solids content (Reference methods). International Dairy Federation standard 2/B, IDF.

International Dairy Federation standard, 1986.Milk: Determination of nitrogen content (Kgeladahl method) and calculate of curd protein content.

International Dairy Federation Standard 20A.

J.Sci., Food Agric., 9;693.International Dairy Federation (IDF), 1969. Determination of the acid value of fat from butter. Reference Method : 6A.

Kebary, K. M. K., A. M. Abeid and R. M.Badawi, 1998. Impact of fat replacers on proteins of low fat processed cheese spread. Cairo, Egypt. Egyptian conf. Dairy Sci, and technol. Pp. 383-401.

Kosikowski, F.V., 1966. Cheese and fermented milk foods. 2nd Ed, p.16.Edwards Brothers, Tnc., Ann Arbor, Mich.

Le-Bars, D. and Gryion J.C., 1981. Role of penicilluim requeforti protein uses during blue cheese ripening. J.D.Res.48:469.

Ling, E.R. 1963. A text book of dairy chemistry .Vol3rd Ed. Chapman and Hall, London.

Abd El-Gawad ,Mona A.M. and Fatma A. M. Hassan, 2000. Manufacture of low fat soft white cheese by using fat replacers. Arab Uni. J. Agric., Ain shams Uni. Cairo, 8 (1), 253-261.

Moore, S. and Stein, W.H., 1954. A modified ninhydrine reagent for the photometric determination of amino acids and related compounds. J.Biol.chem. 211:907.

Vakaleris, D.G. and W.V. price, 1959.A rapid spectrophotometric method for measuring cheese ripening. J. Dairy Sci. 47:264-276.

TDF method [1982],?

SAS(2004). Statistical Analysis System. SAS user's,Statistics SAS Institute Inc. Edititors, Cary, NC.


6/28/2011