Impact of Various Coagulants on Recovery and Quality of Paneer

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Abstract

India is the largest milk producing country in the world with 221.3 million tones milk product and per capital vacuity 471gms day (2024- 25). There's compass for expanding and perfecting the indigenous sweetmeats by introducing a variety of products espousing bettered styles and technology. Paneer is Heat- acid Clotted and an important indigenous milk product, which is considerably used as base material or padding in medication of large number of culinary dishes. Paneer is good source of beast protein to the submissive food. Effect of various coagulant i.e Citric acid (2), moringa leaf (2), Tartaric acid(2) and alum) on Total solid output of paneer prepared using Buffalo and Cow milk. Lactic acid and Buffalo milk could be successfully employed for medication of paneer and give advanced yield (Average 20.86) and total solid recovery (Average 66.39) as compared to using other Coagulant. The type of coagulant also inspired variations in utmost of the ingredients of paneer. The paneer samples made with citric acid, moringa splint, tartaric acid and alum had significantly advanced ($P \leq 0.05$) values for fat, protein, ash, total solids recovery, fat on dry matter base. In order to produce paneer with the most desirable characteristics from reconstituted milk, its suggested citric acid and tartaric acid at 2 attentions can be employed as coagulants.

Key word: Cow milk, Buffalo milk, Paneer, Coagulant, physico-chemical.

1. INTRODUCTION

India is the largest milk producing country in the world with 221.3 million tones milk product and per capital vacuity 471gms day (2024- 25). Pattern of milk operation in India indicates that about 37.7 of total milk produced in India is converted in various milk products which occupies prominent place in Indian economy Chhana, a heat acid clotted product of the milk forms the base material for manufacturing Paneer. Pattern of milk product in India indicates that about 6 per cent of the milk produced is clotted to produce chhana & Paneer is an important indigenous milk product, which is vastly used as base material or padding in drug of large number of culinary dishes. Paneer product in India is about tonnes which amount to Rs. 18 billion. This shows that there is huge opportunity for preparation and selling of paneer. According to PFA act (1976) paneer means the product attained from cow or buffalo milk or combination thereof by rush with sour milk, moringa leaf or citric acid.

The specific point of paneer is that it not only includes casein but also contain whey proteins which get recovered during its manufacture. The yield of protein can be possible due to application of maximum temperature and which results inco-precipitation of casein and whey proteins (Dalgleish 1990). It's primarily used for the medication of a number of largely nutritional culinary medications, snacks and serves as a base for colorful Indian confections like rasogolla, rasamalai, sandesh etc. which are most famous within and to a fair extent outside Asia (Wikipedia 2010). It's calculated that about 50% of total milk produced in India is processed into milk products like ghee, adulation, paneer, chhana, khoa etc. Paneer is the most common dairy product which is processed in india especially in the north. (Chandan 2007). Good quality paneer is character ized by a marble white color, sweetish, mildly acidic taste, nutty flavour, spongy body and nearly knit smooth texture.

It'll not contain further than 72 per cent moisture and the milk fat content shall not be lower than 50 per cent of the dry matter. Paneer is national variety of Indian dish of soft rubbish formulated by particular high acidic flavor with slightly sweet taste, elastic body and close- knit texture. It's a main source of protein and fat. It contains 55- 58 humidity, 25- 28 fat, 19- 21 protein, 2- 3 carbohydrates and 2 to 3.0 minerals. The quality of paneer based on the type and quality of milk utilized, application of heat treatment in milk, category, vigor and amount of types of coagulant used, coagulation temperature and potential of hydrogen of coagulation. Paneer is substantially used as base material in the medication of colorful culinary dishes like curries of peas, potatoes, spinach etc. Paneer snacks are close challengers of those made out of fried fish or funk in terms of fashion ability. Paneer is good source of beast protein to the submissive food. The present study entitled "Effect of different coagulants on yield and quality of paneer" was undertaken with following objectives

1. To regularize the procedure for manufacturing of paneer by using different coagulants agent.

2. To find out yield and total solid recovery of final product of paneer.

3. To find out the different physico-chemical properties of final product of paneer.

2. MATERIAL AND METHODS

2.1 Material:

2.1.1 **Raw milk:**

Bulk raw milk from the herd of crossbred cows and buffalos maintained at dairy unit of AKS University Satna MP is utilized for study.

2.1.2 Coagulants:

For the coagulation of milk during paneer preparations following coagulants were used: 1) Citric acid 2) Moringa leaf 3) Tartaric acid 4) Alum

2.1.3 **Equipments and Accessories:**

Aluminum and stainless-steels vessels. Karahi. Ladle, Muslin cloth, Paneer hoop, Standard weight.

2.2 Methodology

Preparation of Paneer. Paneer was prepared as per the procedure standardized by battacharya et al . The flow diagram of paneer manufacturing is given hereunder:

Flow diagram

Raw Milk (25 to 30 ^{0}C)

⇩

Filtration (Ultra Filtration 0.01-0.1 micron)

⇩

Heat to 85^0 C

⇩

Add 2% (Any Coagulant) in milk at 70^0 C

⇩

Draining of whey (separating the liquid whey from the solid)

⇩

Hooping and pressing (3 to 5 kg/cm^2)

⇩

Cutting into pieces (Slicing)

⇩

Chilling and brining (4 to 10 ^{0}C)

⇩

Storage of paneer (Below 4 ^{0}C)

2.3 Treatments:

Type of milk: T1- Cow milk, T2- Buffalo milk

Type of coagulants C1-Citric acid (2%), C2- Moringa (2%) C3-Tartaric acid (2%) C4-Alum

Treatment combinations/Replications

Table 1: Treatment combinations/Replications

S.No.	Coagulants	Types of milk	Treatments/ Replications
1.	Citric acid C1	Cow milk T1	T1C1, T1C2, T1C3 and T1C4
2.	Moringa leaf C2		
3.	Tartaric acid C3	Buffalo milk T2	T2C1, T2C2, T2C3 and T2C4
4.	Alum C4		

2.4 Replications:

The trial was conducted with 8 replications

2.5 Yield of Paneer:

Yield of paneer of every replication was recorded and percent recovery was calculated

2.6 Physico-chemical analysis

The reconstituted milk and whey were anatomized for colorful physico- chemical charac teristics similar as humidity by AOAC(Association of Official Analytical druggists)(2003) total proteins bymicro-Kjeldahl system, ash by muffle furnace system(AOAC 2003), fat by Gerber system(IS 1977). Paneer is estimated for moisture, fat, protein ash and as per AOAC (2003) guidelines. Fat on dry matter base, total solids recovery and yield were calculated.

3. RESULTS AND DISCUSITION

The results of present work are average of eight replicated data tabulated, presented and discussed along with Statistical analysis under following main heads.

3.1 Total solids recovery:

Data analysis to total solids recovery in paneer prepared from types of buffalo and cow milk by using different coagulants (ie Citric acid, Moringa leaf, Tartaric acid and Alum are presented in Table2,

Table 2: Total solids recovery of paneer (per cent)

Types of Milk	Citric acid C1	Moringa leaf C2	Tartaric acid C3	Alum C4	Mean
Cow Milk (T1)	65.45	61.56	57.23	53.34	59.14
Buffalo Milk (T2)	65.67	62.23	58.48	55.46	60.46
Mean	65.06	61.89	57.85	54.40	59.80

The percent recovery of milk solids of paneer production in buffalo milk was mare than cow milk i.e. 60.46 and 59.14 per cent, independently (Table 1). De and Ray detailed that per cent yield of milk solids as 64.45 and 67.57 per cent in chhana from cow and buffalo milk, individually. Joshi also analysis same trend in respect of recovery of milk solids. He reported 60.33 and 69.56 per cent recovery in chhana from cow and buffalo milk, independently. Surplus yield of milk solids in buffalo milk chhana may be due to maximum fat position in buffalo milk as suggested by De and Ray and Kundu and De. Total solids recovery values showed analogous trends as displayed by total solids content. The results therefore indicate that coagulants did n't have any conspicuous effect on recovery of milk solids in paneer. The findings are in agreements with those of Bhattacharya et al. who reported that buffalo milk paneer contained significantly advanced total solids and showed advanced recovery of total solids in paneer as compared to cow milk paneer. The colorful types of coagulant significantly told the total solids recovery of paneer. The treatments C1, C2 and C3 produced remarkable excess total solids recovery in paneer than treatment C4 i.e. 65.06, 61.89, 57.85 and 54.40 per cent, separately. Sachdeva and singh reported that lactic acid redounded in advanced total solids recovery in paneer (66.47 per cent) than citric acid (62.31 per cent) and tartaric acid (62.15 per cent).

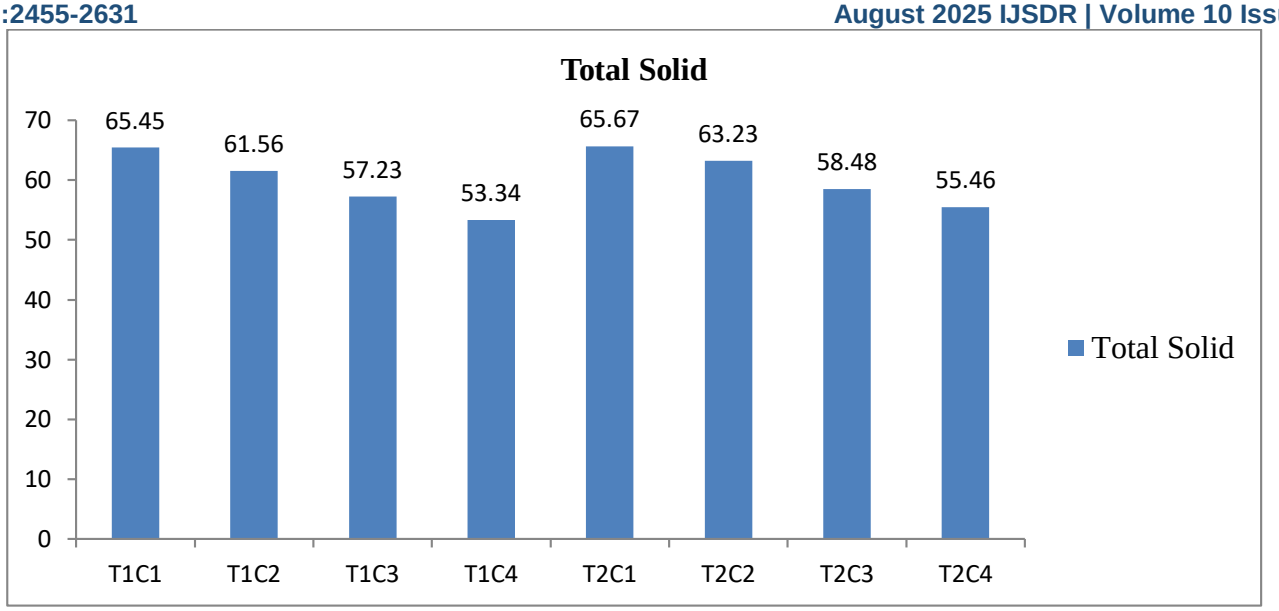

Fig.1: Total solid Recovery in Paneer (In Percentage)

3.2 Recovery of paneer:

The yield of paneer mainly depends upon the type of milk used, heat treatment, coagulant and its concentration and other aspects which are known to vary to a great extent. According to Rao et al . Higher yield (22.35%) of paneer can be obtained from milk heated to 85^0 c and coagulated at 70^0 c. The results given in Table 2 and Fig. 2 reflect the recovery of paneer prepared from cow and buffalo milk with various types of coagulant.

Table 3: Percentage Recovery of Paneer

Types of Milk	Citric acid C1	Moringa leaf C2	Tartaric acid C3	Alum C4	Mean
Cow Milk (T1)	18.25	16.33	16.45	17.25	17.07
Buffalo Milk (T2)	20.76	19.45	19.06	18.00	19.31
Mean	19.50	17.89	17.75	17.62	18.19

The recovery of paneer from buffalo milk (19.31 per cent) was remarkable further than the yield produced from cow milk (17.07 per cent), separately. The results of present discussion are in close agreement with the values reported by Pal et al., Singh and Kanawjia who reported 22.00 ± 1.59 per cent and 21% from buffalo milk. The paneer which is prepared with the help of cow milk has percentage recovery is 18.4 % which was given by Singh and. Syed reported that average yields of paneer were 15.23, 19.25 and 9.85 per cent when made from cow milk that contain 4.5% fat and 8.5% Solid Not Fat and, buffalo milk contain 6% fat

and 9.5% Solid Not Fat. In general, the yield decreases with increase in the strength of coagulant, coagulation temperature and lowering the pH of coagulation in case of buffalo milk and it increases with increase in the coagulation temperature of coagulation in cow milk paneer. The yield of paneer depends substantially on the total solids content of milk and quantum of humidity retained in paneer. According to Chandan the yield of paneer is dependent on the fat and solids not fat content of the starting milk, as well on the humidity, fat and protein retained in the paneer. In the present discussion excess yield of paneer achieved from buffalo milk may be attributed to the maximum total solids content in the milk. Recovery of paneer varied significantly due to coagulants. Important changes in the recovery of paneer prepared with citric acid, moringa leaf, tartaric acid and Alum may be the result of important change in total solids recovery in the product (Table 1). The yield of paneer at treatment C1, C2, C3 and C4 were 19.50, 17.89, 17.75 and 17.62 per cent, independently. Sachdeva and Singh observed 21.80, 20.67 and 23.58 per cent recovery of paneer for coagulants viz citric acid, moringa leaf tartaric acid and Alum independently.

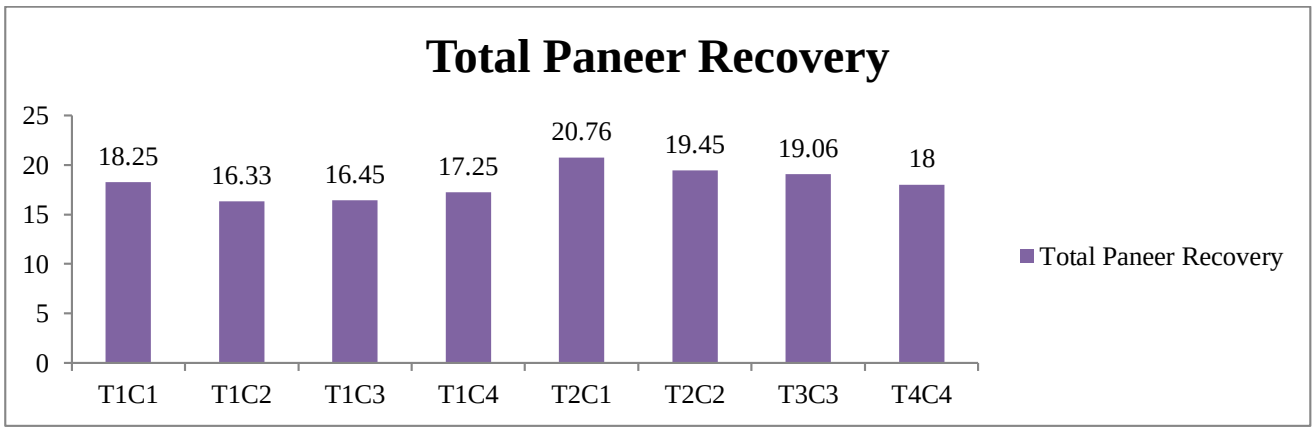

Fig.2: **Recovery of Paneer (Percentage)**

3.3 Physico-chemical characteristics of paneer

The physicochemical characteristics of the paneer like moisture content, Protein, Fat and Ash content are evaluated in present study that shown in table

3.3.1 Moisture Content

The amount of water present in the food sample is called moisture content. Though Moisture content we can analysis the shelf life as well as quality of food because if moisture content in sample become high than water activity will also be high that indicate the spoilage or decomposition in food. The Moisture content may be calculated as reduction of weight per unit total weight.

Table 4: Moisture Content of Paneer

Types of Milk	Citric acid C1	Moringa leaf C2	Tartaric acid C3	Alum C4	Mean
Cow Milk (T1)	56.45	55.23	57.56	59.32	57.14
Buffalo Milk (T2)	54.65	54.92	55.43	57.65	55.66
Mean	55.55	55.07	56.49	58.48	56.39

The moisture content of paneer varied with precipitously variation with coagulant as 2% (ie Citric acid, Moringa splint, Tartaric acid and alum. These results are in harmony with those of Sachdeva and Singh (1988). They've reported that the variation of coagulant was related to humidity in paneer. So the types of coagulant can be used to increase or drop the humidity of paneer as per the demand or to meet legal norms. Still, advanced attention of coagulants were set up to be mischievous for paneer quality. On the other hand, the humidity content displayed significant variation ($P \leq 0.05$) with the type of coagulant as well. The average moisture content in paneer is more than in cow milk as compared to buffalo milk. The amount of water is the loftiest in case of alum paneer and least in the case of moringa leaf.

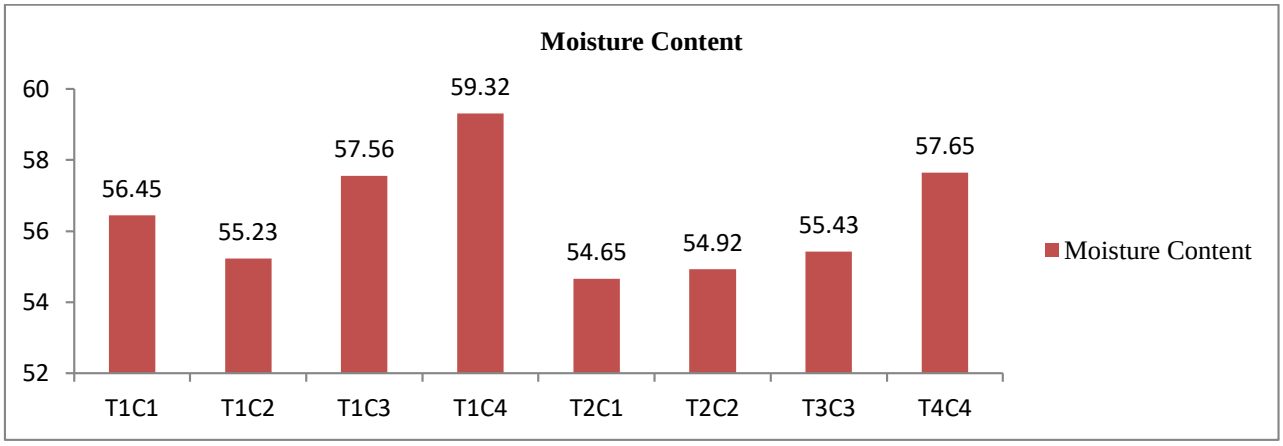

Fig.3: Moisture Content in Paneer

3.3.2 Protein Content

Proteins are large biomolecules and macromolecules that comprise one or more long chains of amino acid residues. A linear chain of amino acid residues is called a polypeptide. A protein contains at least one long polypeptide. Protein content can be analyzed using several methods, with the most common being the Kjeldahl method. These methods primarily focus on determining the total nitrogen content, which is then converted to protein content using a conversion factor.

Table 5: Protein Content of Paneer

Types of Milk	Citric acid C1	Moringa leaf C2	Tartaric acid C3	Alum C4	Mean
Cow Milk (T1)	18.23	17.25	19.23	16.33	17.76
Buffalo Milk (T2)	19.44	18.33	18.50	17.45	18.43
Mean	18.83	17.79	18.86	16.89	18.09

The protein content in the paneer prepared with 2% acid had significantly higher (P≤0.05) values than in the case of tartaric acid and lower in maringa leaf. The increase in the protein content could be due to the increase in the total solid of the paneer which resulted in concomitant increase in the protein content of paneer. However, it is found that the average Protein content in case of buffalo milk (18.43) is greater than cow milk (17.76).

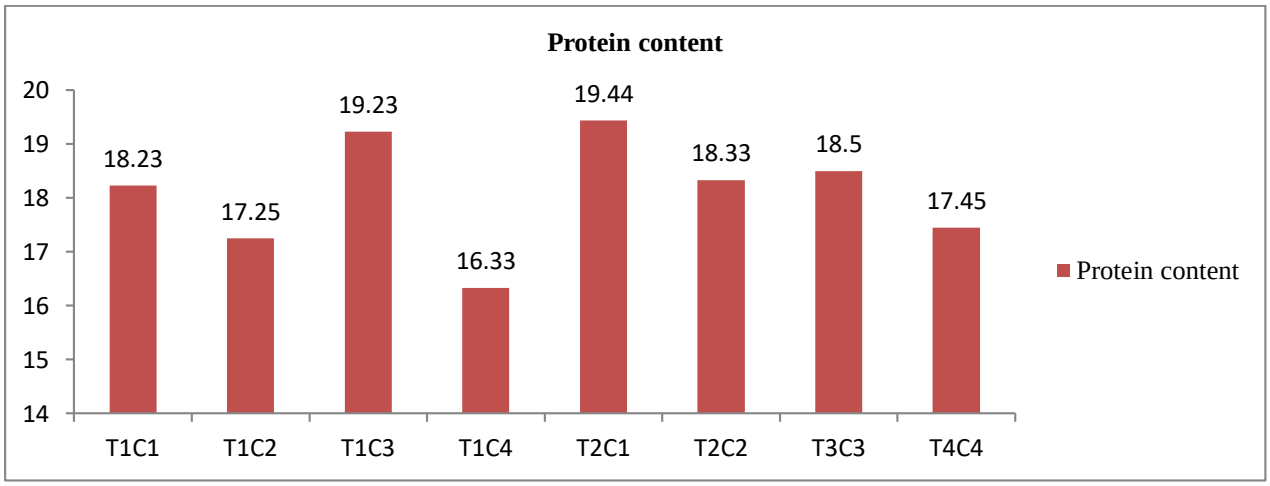

Fig.4: **Protein Content in Paneer**

3.3.3 Fat Content

Fats, also known as lipids, are a crucial macronutrient providing energy, helping absorb vitamins, and protecting organs. They are essential for building cell membranes and hormones. Fat content can be analyzed using various methods, broadly categorized into extraction-based and spectroscopic techniques. Extraction methods, like Soxhlet extraction or automated fat extraction, involve dissolving the fat with a solvent and then weighing the extracted fat.

Table 6: Fat Content of Paneer

Types of Milk	Citric acid C1	Moringa leaf C2	Tartaric acid C3	Alum C4	Mean
Cow Milk (T1)	18.75	17.33	17.80	16.50	17.59
Buffalo Milk (T2)	20.00	17.50	18.90	17.67	18.51
Mean	19.37	17.41	18.35	17.08	18.05

The fat content in the paneer prepared with 2% acid had significantly higher ($P \leq 0.05$) values than in the case of citric acid and lower in alum. The increase in the protein content could be due to the increase in the total solid of the paneer which resulted in concomitant increase in the fat content of paneer. However, it is found that the average fat content in case of buffalo milk (18.51) is greater than cow milk (17.59).

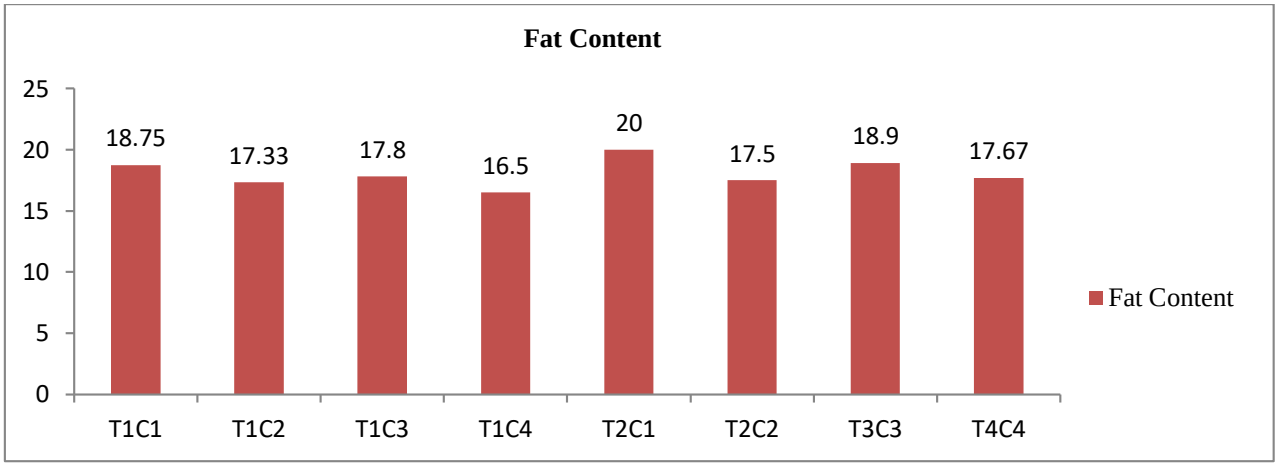

Fig.5: Fat Content in Paneer

3.3.4 Ash Content

Ash content in food refers to the inorganic residue remaining after all the organic matter (like carbohydrates, proteins, and fats) has been burned away through high-temperature heating. Essentially, it represents the total mineral content of a food, including both major elements (like calcium, potassium, sodium, and magnesium) and trace elements (like iron, zinc, and copper). Ash content is determined by ashing a food sample, usually in a muffle furnace, and measuring the remaining inorganic residue.

Table 7: Ash Content of Paneer

Types of Milk	Citric acid C1	Moringa leaf C2	Tartaric acid C3	Alum C4	Mean
Cow Milk (T1)	1.92	1.81	2.02	2.01	1.94
Buffalo Milk (T2)	1.74	1.65	1.98	1.78	1.78
Mean	1.83	1.73	2.00	1.89	1.86

The ash content in the paneer prepared with 2% acid had significantly higher ($P \leq 0.05$) values than in the case of tartaric acid and lower in moringa leaf. The increase in the ash content could be due to the decrease in the total solid of the paneer which resulted in concomitant increase in the fat content of paneer. However, it is found that the average fat content in case of buffalo milk (1.78) is greater than cow milk (1.94).

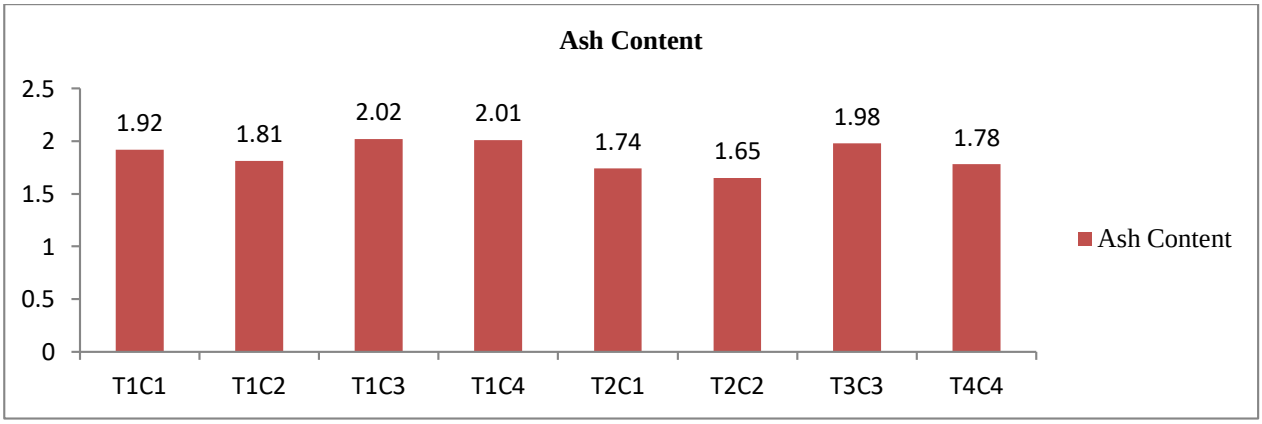

Fig.6: **Ash Content in Paneer**

4. CONCLUSION

From the result of present investigation it may be concluded that citric acid and Buffalo milk could be successfully utilized for preparation of paneer and impart higher yield and total solid recovery as compared to using other Coagulant. The phisico- chemical test of prepared paneer shows the better result with buffalo milk as well as coagulant of citric acid.

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