

# Influence of Different Fried Spice Mix (Cumin, Mustard and Curry Leaves) Level and Coagulants on Chemical and Sensory Qualities of Hard Paneer.

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**Abstract:** This study was done to develop spicy paneer with 3 different coagulants (Acetic acid, Lactic acid, and Citric acid) and 3 spices (Cumin, Mustard, and Curry leaves) fried with ghee added with 1%, 2%, 3%, 4% in to the product. Milk was taken from Livestock farm of Eastern University, Sri Lanka. Developed paneer samples were stored under refrigeration temperature for 15 days to check the shelf life of the product and chemical analysis (titratable acidity and pH). Proximate composition and microbial counts of paneer samples were analyzed using the AOAC method. Sensory evaluation was done for spicy paneer samples using nine-point hedonic scale. Yield of paneer samples were significantly affected ( $p < 0.05$ ) by the coagulant. Paneer samples were prepared with Lactic acid reported the highest amount of yield (155 g for 1% spice mix) and lowest value was observed in Citric acid (123 for 1 % spice mix) which was found to be significantly different. Proximate analysis that citric acid product was having highest amount of total solid and fat (48.66%, 25.40%) while acetic acid product was the lowest (37.59%, 20.24%) found significantly different. Also, found that, spice mixed paneer was in an acceptable level for pathogenic micro-organisms. Sensory evaluation result revealed that, coagulants significantly influenced the sensory attributes and paneer produced from citric acid received a higher rank for overall appearance and acceptability. Chemical characteristics (Titratable acidity and pH) of paneer samples became significantly different for paneer with 4% spice mix level with the storage and were in acceptable range, up to one week of storage. Finally, the study concluded that, spicy paneer produced from cow milk with citric acid and 4 % spice mix was recommended to have a best product.

**Keywords** - Coagulants, Spice mix, Paneer, Storage

## 1. Introduction

Paneer is a variety of soft cheese prepared by acid and heat coagulation of milk. Generally organic acids like citric, lactic or their salt (calcium lactate), lemon juice is used as a coagulant. It is a rich source of high-quality animal protein, fat, minerals and vitamins. (Shahnawaz, U. K., and Mohammad, A. P., 2011). Paneer contains all the milk constituents except for loss of some soluble whey proteins, lactose and minerals (Singh and Kanawjia 1988). It has a fairly high level of fat (22–25%) and protein (16–18%) and a low level of lactose (2.0–2.7%) (Singh and Kanawjia 1990). Availability of different types of milk such as cow, buffalo and goat and its variation in milk composition. Various techniques have been developed for the production of paneer as per the requirements of the consumers with appreciable improvement in the sensory and other quality characteristics. Good quality paneer is characterized by a marble white colour, sweetish, mildly acidic taste, nutty flavor, spongy body and closely knit, smooth texture. The color of product should be pleasing white, with a greenish tinge when

made from buffalo milk and light yellow when made from cow's milk.

Acidification brings about precipitation of casein micelles along with denatured whey proteins and insoluble calcium phosphate (Walstra and Jenness 1983). The type and the concentrations of coagulants used directly have effect on the sensory properties, moisture level and the yield of paneer. According to Bringe and Kinsella (1986), hydration and steric repulsions between casein micelles are reduced by acidification to facilitate hydrophobic interactions resulting in the coagulation of casein micelles. Heat treatment of milk results in destruction of microorganisms, and denatures the whey proteins and retards colloidal calcium phosphate solubility (Ghodekar 1989). Some of the modifications like spice mix level and different coagulants in the preparation of paneer are considered for this research study.

### 1.1. Objectives

- Development of better quality spicy hard paneer by having appreciable improvement in the sensory and other quality characteristics.

- Identify the suitable spice mix level and coagulant for better hard paneer.

## 2. Methodology

### 2.1. Location

Manufacturing of paneer cheese, chemical and microbiological analysis and shelf life evaluation were done at Biosystems Technology Laboratory of Eastern University, Sri Lanka. Some chemical analysis and sensory evaluation were performed at Department of Animal Science, Faculty of Agriculture, Eastern University, Sri Lanka.

### 2.2. Materials

Milk: fresh cow milk was taken from Eastern University livestock farm. Fat and the Solid Non-Fat (SNF) was calculated to standardize the milk for paneer production.

Coagulants: Food grade citric, acetic and lactic acids available at Eastern University was used as a milk coagulant in the preparation of paneer which was purchased from standard chemical suppliers to our Technology Laboratory of Eastern University, Sri Lanka.

### 2.3. Additives in paneer making

To produce good quality paneer from cow milk, 0.08-0.15 % of calcium chloride was added to the milk prior to its coagulation; such treatment led to increased Total Solid (TS) recovery and yield of product.

### 2.4. Optimization of Paneer

Used milk for the paneer preparation was optimized with standard levels of fat (4.5%) using standardization technique (Pearson square method) at a standard heating temperature of 90°C stated by Rajashekar, G *et. al* 2016 was the optimized coagulation temperature for paneer. This milk was cooled to coagulation temperature then, hot solution of three different coagulants: acetic acid, lactic and citric acid were added at 0.2% with vigorous agitation initially and gentle

stirring after that, clear whey was separated out. Coagulum was allowed to settle down for 5 minutes. The separated whey was drained out using a muslin cloth and the curd was added with different levels of the ghee fried spice mix (1.0%, 2.0 %, 3.0%, 4.0% and control sample) filled into the hoop. This paneer mix was subjected to pressing at a pressure around 2.5kg/cm<sup>2</sup> for hard paneer for about 15-20 minutes as per Rajashekar, G *et. al* 2016 recommendation for hard paneer making. Prepared paneer samples will be cut into desired cubes for further analysis. Each replicate was divided into equal parts (30 ± 5 g) and used for the evaluation of sensorial, physico-chemical, and microbial properties.

## 3. Results and discussion

The study was conducted in a systematic approach to study the characterization of paneer in terms of their chemical analysis of the spicy paneer made by different coagulants and were evaluated through overall acceptability and yield of the paneer.

### 3.1. Coagulants and yield

There were some commercial scale coagulants for paneer production used for this study as: acetic acid, citric acid, and lactic acid. Citric acid was more acidity compared to the curd. According to Khan and Pal's (2011) previous study, the strength of coagulant has an effect on the body and texture of paneer. Low acid strength results in soft body and smooth texture, while high acid strength results in hard body. Confirming their findings, paneer developed with curd yielded a soft body and a smooth texture due to the low acid strength of curd and paneer developed with citric acid showed a hard body texture due to the high acid strength of citric acid. Yield of paneer developed from cow milk with different coagulants was significantly different ( $p > 0.05$ ), shown in table 1.

**Table 1 : Yield of the spicy paneer after pressing**

Description	Acetic Acid				Lactic Acid			Citric Acid				
	1%	2%	3%	4%	1%	2%	3%	4%	1%	2%	3%	4%
<b>Yield after pressing(g)</b>	132	130	125	122	155	152	148	147	123	120	118	111

### 3.2. Sensory evaluation of spicy paneer

Spicy paneer samples were stored in a refrigerator for 4 hours and used for sensory evaluation on the same day. Each paneer sample was evaluated using 12 non-trained panelists for appearance, color, flavor, texture and overall acceptability using a nine-point hedonic scale. Paneer made with 3 types of coagulants showed a significant difference ( $p < 0.05$ ) for sensory attributes

such as appearance and overall acceptability while, flavor, taste and texture did not significantly different ( $p > 0.05$ ). Rajashekar, et al. reported that, paneer developed with citric acid yield superior paneer. The spicy paneer with citric acid gave highest acceptable organoleptic qualities

### 3.3. Proximate Composition

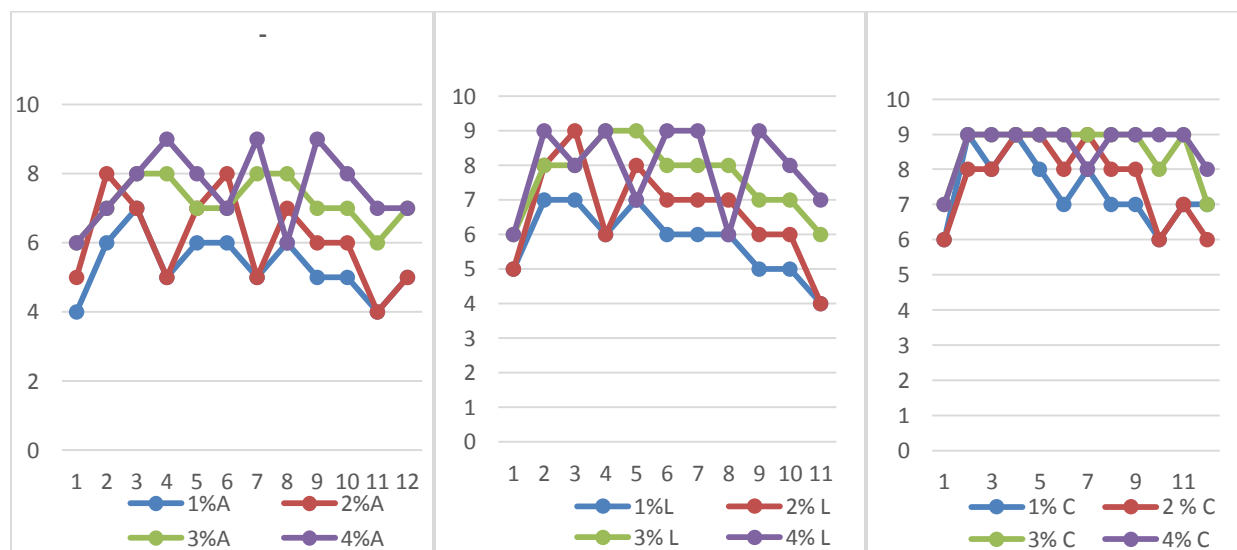
The proximate composition of the hard paneer prepared by varying spice mix level, added with different coagulants will be analyzed as per AOAC method for moisture, fat, protein, ash content and yield.

Proximate composition analysis showed that the acetic acid, Lactic acid, Citric acid used as a coagulant were having the moisture content of 62.41%, 53.54%, 51.34% of moisture respectively and found that the total solid were having negative relationship with the

moisture content. It was observed that the acetic acid used as a coagulant having significantly higher level of moisture content ( $p < 0.05$ ) than both lactic and citric acid. But citric acid used as a coagulant was having significantly different than acetic acid on total solid ( $p < 0.05$ ) but not significantly different than lactic acid coagulant. Paneer developed with citric acid with 4% spice mix in this study also obtained better preferences than other samples.

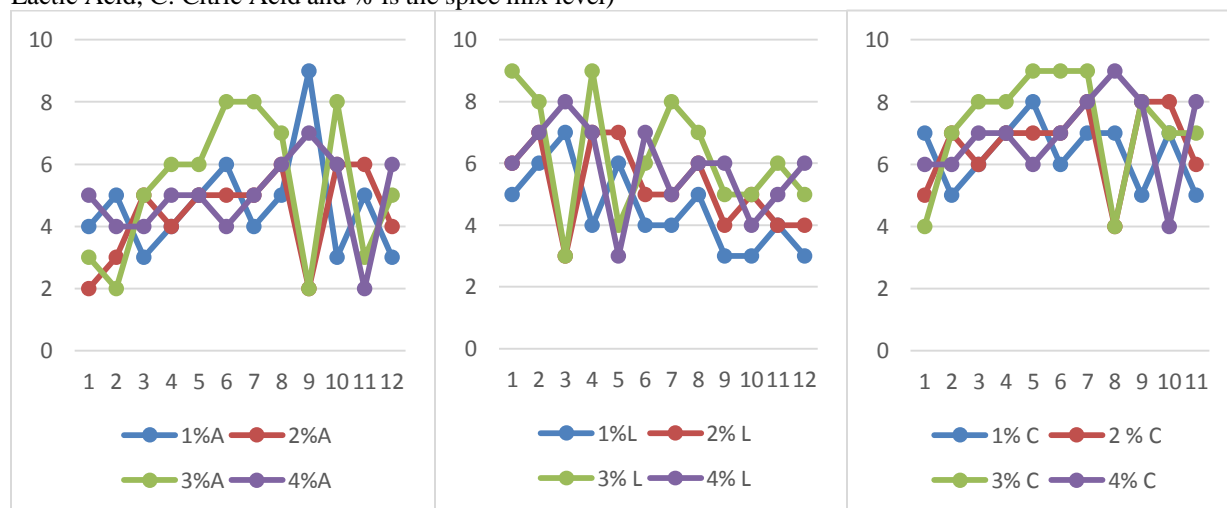
**Table 2: Proximate analysis of 4% spice added paneer samples**

Proximate Analysis %	Acetic Acid	Lactic Acid	Citric Acid
Moisture	62.41	53.54	51.34
Total Solid	37.59	46.46	48.66
Fat	20.24	22.23	25.4
Ash	1.88	2.19	1.67

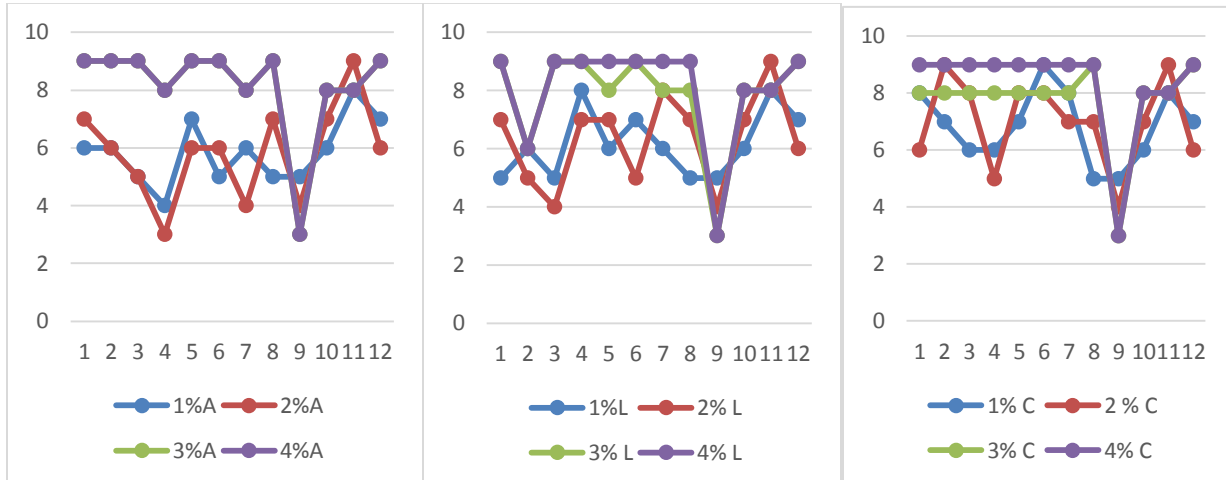


**Graph 1: 9-point hedonic Scale graph - Appearance Vs Spice mix**

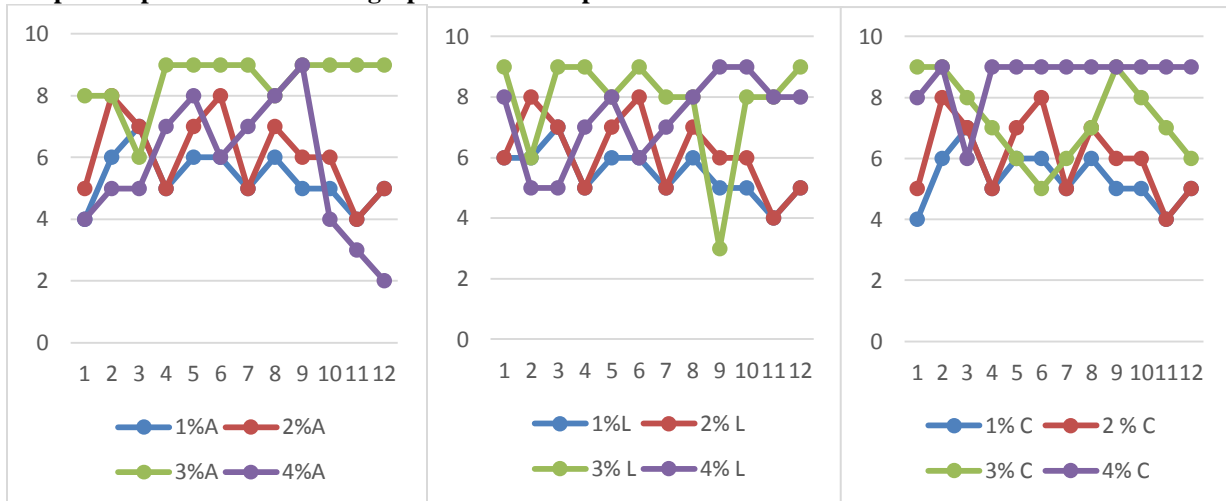
X axis is the 9-points hedonic scale and Y axis is the preference of the sensory panel members. (A: Acetic Acid, L: Lactic Acid, C: Citric Acid and % is the spice mix level)



**Graph 2: 9-point hedonic Scale graph - Texture Vs Spice mix**



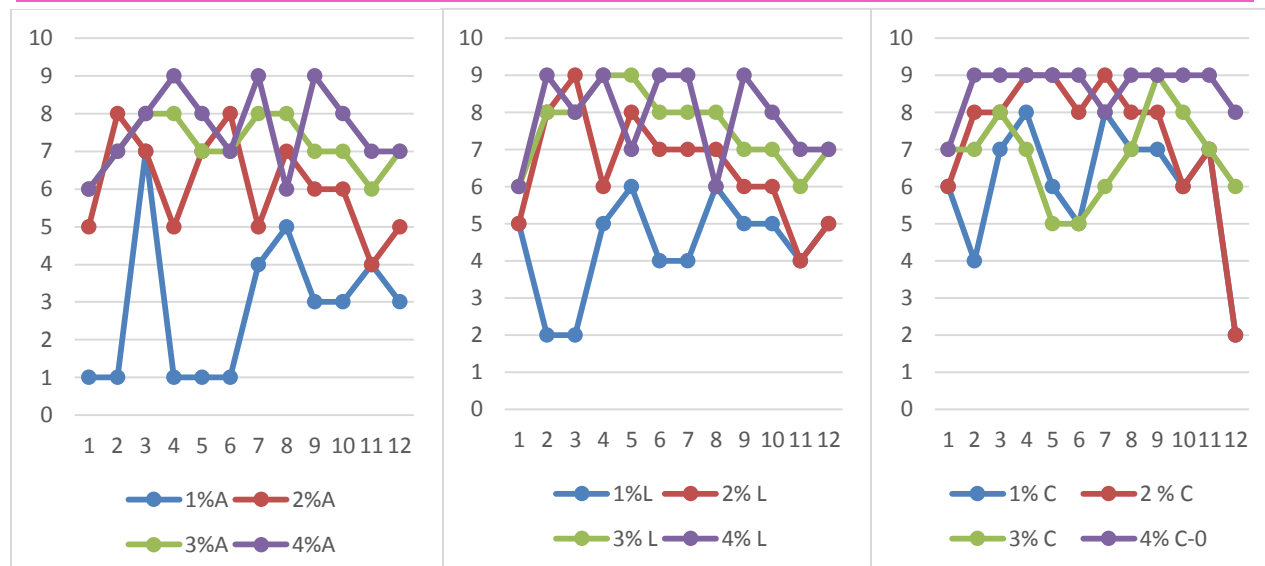
Graph 3: 9-point hedonic Scale graph - Color Vs Spice mix



Graph 4: 9-point hedonic Scale graph - Taste Vs Spice mix

Paneer are significantly affected by different coagulant used, therefore the fat, moisture and yield content were significantly affected on the texture, taste and overall acceptability also. The

textural properties of paneer vary significantly with the level of fat, moisture and yield content as well as difference in coagulants.



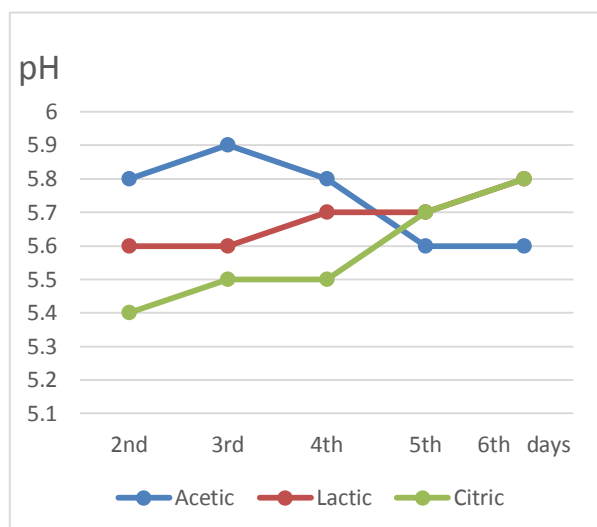
**Graph 5: 9-point hedonic Scale graph Overall Acceptability Vs Spice mix**

**3.4. Physico-chemical analysis**

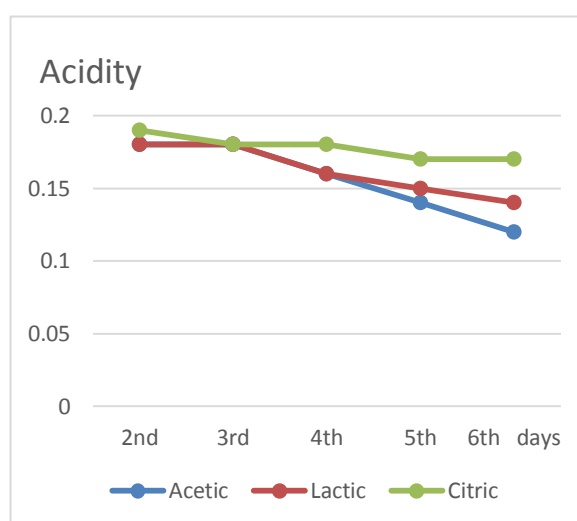
Spicy Paneer samples were analyzed for some basic physico-chemical parameters such as moisture, total solids and ash by gravimetric method, fat by Gerber method, pH by digital pH meter and titratable acidity by standard procedure described in AOAC. The pH and

titratable acidity of developed paneer were significantly affected ( $p < 0.05$ ) by different coagulants.

In most of the developed spicy paneer, pH decreased with storage time due to the development of acid. In general, microbial count increases with the time and these microbes ferment lactose in to acid. Therefore, with the time, acidity level increases and pH decreases.



**Graph : 6 pH of the spicy paneer (4%)**



**Graph : 7 Acidity spicy paneer (4%)**

**3.5. Microbiological Analysis**

Total plate count of the spicy paneer samples of Acetic acid, Lactic acid, citric acid coagulants were found to be  $3.2 \times 10^3$ ,  $5.0 \times 10^4$ ,  $4.0 \times 10^4$  CFU respectively. According to IS: 10484 (1983) standards, the recommended total plate count, yeast and moulds count and *E. coli* were  $< 5 \times 10^5$ ,  $< 250$  and  $< 90$ , respectively. The developed paneer was negative for pathogenic microorganisms (Table 3).

Aggarwal and Srinivasan (1980) reported, that microorganisms such as coliforms, yeasts and moulds that might be present in raw milk, get destroyed completely when milk is heated at 82°C for 5 min. However, these microbes may contaminate the product through a number of sources; air, water, equipment, knife, muslin cloth, and persons handling the products.

**Table 3: Microbiological analysis of 4% spice mix paneer**

<i>Microbial count (CFU)</i>	<i>Acetic Acid</i>	<i>Lactic Acid</i>	<i>Citric Acid</i>
Total Plate count	3.2 x 10 <sup>3</sup>	5.0 x10 <sup>4</sup>	4.0 x10 <sup>4</sup>
Mold	55	140	80
E. coli	02	-	-

#### 4. Conclusion

Spicy paneer with Different coagulants such as acetic acid, lactic acid, citric acid with cow milk can be used to prepare paneer with acceptable sensory

qualities. In order to produce spicy paneer with the most desirable characteristics from cow milk, it is suggested citric acid and 4 % of spice mix level to have a better product.

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