INTRODUCTION

Majority of people have a sweet tooth and find every reason to celebrate occasions with sweets which is why ‘confectionery industry’ is bound to be the largest and most popular among the food processing sector (Thakkar, 2011). Healthy ingredients are added to brands to produce functional products (Wright, 2007). 

Whey is one of the largest by-products of world dairy industry (Changade et al., 2012). Several attempts are made to incorporate whole whey in many food products for the economic benefit of dairy industry, to utilize valuable nutrients for human consumption (Mathur and Shahani, 1979). Food manufacturers are increasingly viewing whey products as an ideal means of achieving added value but because of high mineral content and low pH, use of acid whey pose considerable difficulties and therefore remain unutilized (Gupta, 2008).

Whey is high in organic matter with biological oxygen demand varying from 39,000 to 48,000 ppm which is 200 times more as compared to domestic sewage (Sahu et al., 2005). Out of 85 million tonnes of global production, 40% is still disposed as raw whey in to sewage (Dhawale et al., 2009). Primary treatment of 5 lakh liters of whey would cost $10,000 per day (Khamrui and Rajorhia, 1998). Today it is not possible to dump whey because of environmental pollution and it is not economically feasible to build a purification plant leaving us with only one alternative, ‘to utilize whey’ (Knipschildt, 1977). Diversification of whey solids to human food chain employing cost effective technologies appear to be the best alternative to utilize whey (Changade et al., 2012).

Jelly is a confectionery product that includes soluble solids in the form of sugar as well as pectin (Patrella, 2008). It is commonly relied on to add palatability of the diet, especially in lower income groups (Human, 1949). It gives pleasant mouth feeling, good looking product appearance, high acceptability to food products and satisfy craving for sweets (Ognean et al., 2007). Normally jellies are prepared from combinations of gelling agent, synthetic flavours, sugar or glucose syrup and acidified with citric acid (Imeson, 2010). They can be manufactured with many interesting variations using hydrocolloids principally, arabic gum, starch, gelatin, agar and pectin (Booth, 1997). Considerable work has been done throughout the world to utilize whey for producing WPC, whey powder, lactose (Changade et al., 2012), hydrocolloid ‘xanthan gum’ (Nikam et al., 2011), as an efficient carbon and nitrogen source (Kumari and Dhingra, 2013) etc. However, Sharma and Raghuvanshi (2003) concluded that whey cannot be utilized in preparation of fruit preserves. Rao et al. (2003) and Sharma (2014) also agreed with this finding due to perishable nature of fruits whereas Patel and Arora (2005) stated that the native functional virtues of whey proteins along with the fiber functionality of pectin will greatly elevate the status of dairy products for the benefit of consumers of all age groups.

Pectin is a valuable by-product from fruit wastes (Raj et al., 2012). It is most complex polymer of plant cell polysaccharides and in a normal western diet, around 4-5 g pectin is consumed each day with worldwide annual consumption around 45 million kilograms (Willats et al., 2006). Pectin is finding more and more use in the confectionery and pharmaceutical industry (Imeson, 2010). The power of pectin to revolutionize...
structure of sol system to generate gel network along with its plant-originated nature and numerous health benefits resulted in its ever-growing applications for creating edible gelled systems (Haghghi and Rezaei, 2012). Jellies made from pectin have several advantages over those made from other hydrocolloids (Baker and Olliver, 1952).

Entrepreneurship promotion in dairy and food industry is a noble concept for attracting the farmers, so as to uplift them (Cheema, 2005). Present work was aimed to study the possibility of using paneer whey in jelly confection.

MATERIALS AND METHODS

A composite sample of fresh whey (Table 1) was obtained as a by-product during paneer preparation by coagulating mixed milk using 1-2% citric acid solution as coagulant (De, 2008). Paneer whey was analyzed for total solids, titrable acidity, pH, total ash and total protein content according to the standard procedure recommended in standard methods of ISI (1981), filtered using double layered muslin cloth and separated twice using cream separator. This whey was used with potable water in different proportions for various treatments viz., 00:100 (T1), 25:75 (T2), 50:50 (T3), 75:25 (T4) and 100:00 (T5) along with different ingredients as shown in material balance (Table 2). The procedure described by Human (1949) was followed for making paneer whey based jelly confection with slight modifications. Each treatment was added with analytical grade citric acid of ‘Himedia’ make (RM-6826) @ 1%, food grade aqueous orange colour of ‘Trishul’ brand and aqueous orange flavour of ‘Flying Bird’ brand @ 0.1% and 0.2% respectively on weight basis. All the blends were heated and simultaneously stirred @ 25-30 rpm till reaches to 76-78°C. ‘Himedia’ make powder form high methoxyl pectin (RM-396) of jelly grade 150 ± 5 @ 1.5% and ground sucrose @ 15% were mixed together and added to each of the above blends at 77-82°C. Hot homogenous blends were obtained by passing each through the food processor for 5-6 seconds at 70-75°C. Homogenous mass was poured into sterilized stainless steel open pot and placed for further heating. Another lot of ground sucrose @ 32.5% by weight of total mass was added pint by pint with continuous stirring @ 25-30 rpm. Thus, a total of 47.5% ground sucrose was used for each treatment. This mixture was concentrated at 95-105 °C till reaches to 65 °Brix. Foams formed during mass heating were removed using perforated ladle. Jelly mass was filled in ¾ capacity of sterilized stainless steel circular moulds (12 cm diameter and 2 cm height) and allowed to cool and set at room temperature (28-32 °C) for 20-25 minutes. Intact jelly mass was removed and placed over sterilized stainless steel plates. The mass was cut manually to 2 x 0.7 x 0.8 cm³ size pieces using sterilized stainless steel knife. The average weight per piece was 2.5-3 g. Each piece was twist wrapped in 7x5 cm³ polypropylene wrappers (Table 3). All the samples from five replications were subjected to sensory evaluation by a panel of five judges on 9 point Hedonic scale as per standard procedure described by Deen and Singh (2013). Data was statistically analyzed using standard method of Completely Randomized Design (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

The sensory evaluation attributes viz., colour, flavour, body and texture, appearance and overall acceptability were judged, results recorded in accordance with the total scoring given by the panelists of each assortment of the new product. There was no significant difference between treatments T1, T2, T3, T4 and T5 for all the sensory attributes. The highest colour score (7.52 ± 0.65) was observed for T2 and lowest score 7.40 ± 0.81 and 7.40 ± 0.80 was recorded for T4 and T5 respectively (Fig. 1). Scores recorded for colour are according to Hussain and Shakisir (2010) and Lago-Vanzela et al. (2011).

The score for flavour decreased with increasing level of paneer whey. Treatment T1 (Control) and T2 recorded highest flavour score 7.52 ± 0.58 and 7.52 ± 0.63 respectively (Fig. 2). The results are in line with Kumari and Sandal (2010) for whey based mango jam and Islam et al. (2012) for strawberry jam. Flavour scores were slightly higher than that reported by Aggarwal et al. (1997) for grape and guava blend jelly.

Body and texture score increased with the increase in level of paneer whey from 50 to 75% may be due to additional total solids from whey. The jelly confection with 75% paneer whey (T4) scored highest flavour score 7.08 ± 0.57 (Fig. 3). Results recorded are in harmony with Islam et al. (2012) for strawberry jelly and Hossen et al. (2009) for guava jelly. The lowest score for appearance 7.36 ± 0.62 was received for jelly confection obtained from 25% paneer whey (T2) and the highest score 7.48 ± 0.62 was given to jelly confection with 75% (T4) paneer whey (Fig. 4). Similar scores for appearance were recorded for jambolan jelly (Lago-Vanzela et al., 2011). The lowest score for overall acceptability 7.32 ± 0.73 was recorded for treatment T1 and highest score 7.48 ± 0.71 was allotted to treatment T3 (Fig. 5). The scores recorded are in agreement with Kumari and Sandal (2010) for whey

Table 1: Physico-chemical properties of paneer whey

<table>
<thead>
<tr>
<th>Properties</th>
<th>Values</th>
</tr>
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<tbody>
<tr>
<td>Total solids</td>
<td>± 0.04%</td>
</tr>
<tr>
<td>Titrable acidity</td>
<td>00.38 ± 0.01%</td>
</tr>
<tr>
<td>pH</td>
<td>05.61 ± 0.11</td>
</tr>
<tr>
<td>Protein</td>
<td>00.35 ± 0.01%</td>
</tr>
<tr>
<td>Ash</td>
<td>00.40 ± 0.14%</td>
</tr>
</tbody>
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Table 2: Material balance for different treatments

<table>
<thead>
<tr>
<th>Ingredient (g)</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>500</td>
<td>375</td>
<td>250</td>
<td>125</td>
<td>000</td>
</tr>
<tr>
<td>Paneer whey</td>
<td>000</td>
<td>125</td>
<td>250</td>
<td>375</td>
<td>500</td>
</tr>
<tr>
<td>Sugar</td>
<td>475</td>
<td>475</td>
<td>475</td>
<td>475</td>
<td>475</td>
</tr>
<tr>
<td>Pectin</td>
<td>015</td>
<td>015</td>
<td>015</td>
<td>015</td>
<td>015</td>
</tr>
<tr>
<td>Citric acid</td>
<td>010</td>
<td>010</td>
<td>010</td>
<td>010</td>
<td>010</td>
</tr>
<tr>
<td>Total</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
</tr>
</tbody>
</table>

Table 3: Specifications of polypropylene wrapper

<table>
<thead>
<tr>
<th>Clarity</th>
<th>Translucent</th>
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</thead>
<tbody>
<tr>
<td>Grease resistance</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Thickness</td>
<td>0.02 mm</td>
</tr>
<tr>
<td>Specific gravity</td>
<td>0.90</td>
</tr>
<tr>
<td>Weight</td>
<td>0.007 g/(cm²)</td>
</tr>
</tbody>
</table>
based mango jam. Hossen et al. (2009) also observed similar results for guava jelly.

REFERENCES


Knipschildt, M. E. 1977. Utilization of whey to avoid pollution and
to recover a valuable food product part I. Manufactured Milk Products Supplement. *American Dairy Review*. pp. 52B-52F.


