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EFFECT OF ELECTRICAL CONDUCTIVITY AND REFRACTIVE INDEX ON ADULTERATED MILK SAMPLES

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ABSTRACTS

Milk is a product of biological origin and can accommodate any additive without apparent changes in its appearance. Milk is the almost perfect food that supplies all necessary nutrients hence its quality needed to be checked for adulteration. In the present investigation milk samples were collected from local dairy farmers and vendors and analysed in the laboratory for quality testing specifically adulteration in milk. The received raw milk samples were tested in laboratory for electrical conductivity and refractive index as control T0 and then adulterated with water, sugar, starch, urea and salt of the concentration as treatment T1 (1%), T2(2%), T3(3%), T4(4%), and T5(5%) of the milk samples each respectively. The electrical conductivity values get decreased with increase in adulterant. The electrical conductivity values showed less in control values in cow milk samples than adulterated samples indicates effect of adulteration on electrical conductivity. Salt adulterated samples showed increased value of electrical conductivity. The refractive index also affected due to addition of different level of adulterants. Increased value of refractive index shows the adulteration of sample with water, sugar, starch and urea. Chemical method for determination of adulterants is time consuming method. From the present investigation it is concluded that electrical conductivity and refractive index method is very effective to examine the adulterated samples. These methods also saves time to examine the adulterated samples. Therefore it is recommended that electrical conductivity and refractive index

methods can be used for rapidly testing many milk samples within few minutes in dairy industry.

Introduction

The milk is almost perfect food available in nature and supplies most of the essential nutrients to the consumers in the digestible form (Kumar and Rai, 2010). It is th cheapest source of nutrition accepted by all age groups in rural and urban areas. Hence, it is almost necessary to check its quality regularly. The milk is the product of biological origin and can accommodate any additive substance without apparent changes in its appearance. The water, starch, sugar, urea and salt are common adulterants in milk (Sadat, et al., 2006). Water is added to increase the volume , urea is added to provide whiteness, increase the consistency and leveling the contents of SNF as present naturally.

Starch, carbonates, and bicarbonates are also added to adjust the contents as present in natural milk. The water decreases the nutritive value, urea affects on kidney, starch causes diarrhea where as carbonate and bicarbonate cause disruption in hormone regulation (Singuluri and Sukumaran, 2014). Thus it is necessary to check the milk for adulteration before distribution and consumption. For detection adulteration in milk chemical test or adulteration testing kits are available in market (Kamthania, et al., 2014). In the present investigation the efforts are made to detect these adulteration in milk by electrical conductivity measurements and the refractive index.

Materials and Methods

The present investigation was carried out in the department of Dairy science, Mahatma Basweshwar College, Latur (Maharashtra State), India. Milk samples from pure cow breeds i.e. Deoni and Red kandhari were collected. From each breed five animals and from them in the morning and evening milk samples were collected for five days in pre sterile container. As soon as milk collected it was analysed within two hours. Milk was analysed for electrical conductivity (Mucchetti, et al., 1994), refractive index by Abbes refractometer (Rangappa, 1947). To judge the effect of adulterants various levels [T1 (1%), T2 (2%), T3 (3%), T4 (4%), T5 (5%)] adulterants like water, sugar, starch urea and salts were added and analysed. Adulterants were tested adulteration kit of NDDB Gujarat for conformation.

Results and Discussion

The Table, 1 shows the electrical conductivity of milk adulterated with different level of adulterants. The table shows that the electrical conductivity of milk decreases with the increase in concentration of water. This work is also in conformity with that of Mabrook and Petty (2003) who studied the effect of composition on the electrical conductivity of milk. The Pal (1963) also reported the changes in electrical conductivity after the adulteration. The electrical conductivity decreased with increase in concentration of sugar. In sample T0 (Deoni breed) the electrical conductivity was 0.00366 whereas as with steady decrease it is decreased to 0.00312 in sample T5. Same findings were also observed in case of Red kandhari breed where in T0 sample the electrical conductivity was 0.00369 and it is decreased to 0.00339 in T5 sample. The same findings are also reported by Pal (1963) and Mabrook and Petty (2003). The Deoni cow breed milk sample T0 shows electrical conductivity i.e. 0.00366 then it is reduced to 0.00340 in T5 milk sample. As the concentration of starch increased the electrical conductivity of all the samples decreased. It shows that concentration of starch directly affects on the electrical conductivity. Same results were also found in case of urea adulteration. The table also shows the effect of concentration salt adulteration on the electrical conductivity. During the present investigation it is observed that as the concentration of salt increased the electrical conductivity also increased. In sample T0 of Deoni cow breed the electrical conductivity was 0.00366 which is then increased to 0.03292. whereas as in Red kandhari cow breed the electrical conductivity in sample T0 was 0.00369 and increased to 0.03792 in sample T5. It shows that as salt contents increases the electrical conductivity also increases. The same findings are also reported by Puri and Prakash (1964), Jannis, et al., (1978), Henningson, et al. (2005) and Kartheek, et al., (2011) who reported the co-relation between chloride and conductivity.

Table,1 Effect of level of various adulterants on electrical conductivity of milk samples

Cow Breeds	Adulterants	Treatments					
		T0	T1	T2	T3	T4	T5
Deoni	Water	0.00366	0.00318	0.00317	0.00315	0.00314	0.00311
Red Kandhari		0.00369	0.00332	0.00328	0.00320	0.00322	0.00319
Deoni	Sugar	0.00366	0.00334	0.00333	0.00332	0.00317	0.00312
Red Kandhari		0.00369	0.00350	0.00351	0.00351	0.00342	0.00339
Deoni	Starch	0.00366	0.00346	0.00344	0.00343	0.00342	0.00340
Red Kandhari		0.00369	0.00358	0.00355	0.00355	0.00354	0.00353
Deoni	Urea	0.00366	0.00326	0.00325	0.00323	0.00322	0.000320
Red		0.00369	0.00327	0.00306	0.00325	0.00323	0.00321

Kandhari							
Deoni	Salt	0.00366	0.03236	0.03244	0.03253	0.03256	0.03292
Red Kandhari		0.00369	0.03112	0.03592	0.03692	0.03720	0.03792

Table,2 Effect of level of various adulterants on refractive index of milk samples

Cow Breeds	Adulterants	Treatments					
		T0	T1	T2	T3	T4	T5
Deoni	Water	1.3469	1.3456	1.3400	1.3452	1.3457	1.3449
Red Kandhari		1.3473	1.3406	1.3432	1.3432	1.3482	1.3472
Deoni	Sugar	1.3469	1.3450	1.3449	1.3448	1.3445	1.3443
Red Kandhari		1.3473	1.3464	1.3455	1.3443	1.3431	1.3423
Deoni	Starch	1.3469	1.3481	1.3462	1.3434	1.3422	1.3404
Red Kandhari		1.3473	1.3375	1.3372	1.3371	1.3369	1.3366
Deoni	Urea	1.3469	1.3439	1.3438	1.3437	1.3434	1.3433
Red Kandhari		1.3473	1.3470	1.3463	1.3460	1.3456	1.3451
Deoni	Salt	1.3469	1.3453	1.3450	1.3449	1.3447	1.3448
Red Kandhari		1.3473	1.3164	1.3306	1.3374	1.3424	1.3433

The Table, 2 shows the effect of concentration of various adulterants on refractive index of cow milk. The table shows that refractive index of milk decreases with the increase in concentration water (T0). The refractive index of unadulterated raw milk observed 1.3469 and 1.3473 Deoni and Red kandhari cow breed respectively. These refractive index decreased to 1.3449 and 1.3472 in sample T5 of Deoni and Red kandhari respectively. The effect of water adulteration on refractive index is also reported by Rangappa (1947). The milk samples were adulterated with sugar to test its effect on refractive index. The sample T0 i.e. control sample was without the sugar addition, it showed the 1.3469 and 1.3473 refractive index for Deoni and Red kandhari cow breed respectively. These samples then showed the decreased value i.e. 1.3443 and 1.3423 in T5 samples for Deoni cow breed and Red kandhari cow breed. Same findings were also observed in case of starch, urea and salt adulterants, where all

the values get reduced after the addition of these adulterants. The same findings are also reported by Rangappa (1947) and Ahirwar, et al., (2015).

Conclusion

The present investigation was carried out to find out the effect of addition of adulterants on electrical conductivity and refractive index. The electrical conductivity values get decreased with increase in adulterant. The electrical conductivity values showed less in control sample in cow milk than adulterated samples, indicates effect of adulteration on electrical conductivity. Salt adulterated samples showed increased value of electrical conductivity. The refractive index also affected due to addition of different level of adulterants. Increased value of refractive index shows the adulteration of sample with water, sugar, starch and urea. Chemical method for determination of adulterants is time consuming method. Therefore from the present investigation it is concluded that electrical conductivity and refractive index methods are very effective to examine the adulterated samples. These methods also save time to examine the adulterated samples. Therefore it is recommended that electrical conductivity and refractive index methods can be used for rapidly judging many milk samples within few minutes in dairy industry.

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