## ABSTRACT

*Dahi* (curd) is a traditional fermented milk product of India obtained by the activity of mixed mesophilic cultures of lactic acid bacteria capable of producing acid and the major flavour compound diacetyl. Its therapeutic and nutritional properties are well established and it is highly appealing to the Indian palate. However, like all other dairy products, it is deficient in iron. Refreshing *dahi* drinks like lassi are also popular in India especially during the summer. Despite the wide popularity and therapeutic value of *dahi*, its shelf life is limited and is maintained under refrigerated condition during its marketing and distribution which adds to cost. This can be taken care of by drying. A need was felt to generate kinetic data for *dahi* fermentation systems and to develop appropriate technology for production of shelf – stable, free flowing *dahi* powder.

The simultaneous effects of fermentation temperature (20.8°C - 29.2°C), total solids level (13 - 16 % w/v) and total inoculum level (1 - 4 % v/v) on the acidification process in buffalo milk fermented with *dahi* culture was found out. The acidification kinetics during fermentation and the textural properties of *dahi* were studied. The sensory quality of *dahi* prepared from whole and standardized buffalo milk at varying levels of inoculum were also evaluated. The optimum fermentation process was used for preparation of *dahi* and the suitability of preconcentrated *dahi* as a raw material for manufacture of *dahi* powder was evaluated. Sorption behavior of *dahi* was investigated which was used in drying and storage studies. *Dahi* samples were dried in recirculatory convective air dryer, conditioned and ground into free flowing powder. The drying process parameters were optimized. The drying data were analyzed for studying the drying behaviour and effective moisture diffusivity. The formulation of health drink mix by fortification of *dahi* powder with ferrous sulphate and energy drink mix by blending caffeine with *dahi* powder were carried out using fuzzy analysis. The quality analysis of *dahi* powder and formulated health and energy drink mixes were also done. Changes in quality of *dahi* powder packaged in metallised polyester pouches during accelerated storage were studied and shelf life was assessed.

Both the total solids content and inoculum level had significant effect on the hardness and syneresis of *dahi* samples. *Dahi* prepared from standardized milk had superior texture than *dahi* from whole buffalo milk. To obtain a firmer gel medium

acidification rate was preferred which was achieved in the range of higher fermentation temperature (27 - 29.2 °C), medium total solids (14.5 - 15 %) and at a TI of 2.5 %. The sorption isotherms of *dahi* were typical type II sigmoidal curves according to BET classification. The model proposed by Midilli *et al.* (2002) was found to be the best fit under most of the experimental conditions for *dahi* drying investigated. Effective moisture diffusivity was found to increase with both sample thickness and drying temperature.

*Dahi* (14.5 % TS and pH 4.7) was converted into free flowing powder by recirculatory convective air drying for 8.0 h using hot air temperature 50 °C, air velocity 2.5 m/s and sample thickness in the drying tray 4mm, followed by cooling, conditioning for 1.5 - 2 h under 10 °C, 10 % RH and grinding. From 1 Kg buffalo milk containing 6.6% Fat and 8.79 % SNF, 1.525 Kg of standardized milk (4.5 % Fat and 10 % SNF) was obtained. This gave 1.564 Kg *dahi* (14.5 % TS), which was subsequently converted into 206 g free flowing powder containing 4 % moisture content (db). The *dahi* powder had $1.7\times10^7$ cfu / g *Lactococci*, 95.2 % dispersibility and 12.4 colour change. The acidity of the sample was 5.6 % (w/v lactic acid) and its bulk density was 0.55 g /cc. The powder could be reconstituted well into *dahi* drink by mixing with lukewarm (40 °C) water in a mixer for 2 min. The *dahi* powder in metallised polyester pouches had $2.8\times 10^4$ cfu / g *Lactococci,* 220μ equiv./ g FFA, 0.223 (OD at 532 nm) TBA, 394.2 μ mol/ kg HMF and after 49 days of storage under accelerated conditions. It retained its free flow characteristics up to 52 days during storage.

The formulated health drink contained *dahi* powder (10 %), ferrous sulphate (10 ppm), Ascorbic acid (40 mg / 100 ml) and sucrose (9 %). The energy drink formulation contained *dahi* powder (10 %), glucose (5 %), caffeine (10 mg /100 ml) and strawberry flavour (0.02 %). The TBA value increased and the *Lactococci* count decreased during storage of health drink mix. There was no significant increase in TBA value during the storage of caffeine containing energy drink mix.

***Key words***: *Dahi*, acidification kinetics, convective drying, health drink, energy drink, fortification, fuzzy, response surface methodology, fermentation