Effect of coating on the viability of probiotics in liquid filled capsules

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INTRODUCTION

Probiotics are live microbial organisms and are thought to improve general well-being. More recently it has been reported that probiotics may be beneficial in the treatment of antibiotic associated diarrhoea [1].

Liquid filled capsules can be coated with an enteric coat to control release of the capsule contents at the target site of the delivery, for example the lower intestine or colon. The coating process can often involve moisture application and exposure to increased temperatures during drying. Probiotics can be sensitive to moisture and heating and coating may affect bacterial viability.

EXPERIMENTAL METHODS

Two probiotic powders, Lactobacillus rhamnosus LB21 and Lactobacillus plantarum LB931 (freeze dried in trehalose), were formulated in Miglyol 812N (Medium chain triglyceride) and Aerosil 200 (viscosity modifying agent). The formulation was filled into size 3 hard gelatin capsules using HiBar liquid fill equipment and were banded with a 25% gelatin solution using a bench Qualiseal banding machine.

Following band drying, capsules were subjected to a coating procedure using a Aeromatic Strea-1 coater.

• To investigate the effect of moisture and heat application, capsules were fluidised and sprayed with 160 g of water at 3 different spray rates, in order to mimic moisture exposure during the application of a 30 mg/capsule coating. For the low spray rate 0.55 g of water per minute was applied over 175 minutes, for the medium spray rate 1.95 g/minute was applied over 75 minutes and for the high spray rate 3.07 g/minute was applied over 50 minutes. Spraying was performed at 40°C for all spray rates, for the specified time period.

• To assess the effect of heat only, capsules were fluidised without spraying at a drying temperature of 40°C for 75 minutes.

Capsules were assessed visually and the viability of the probiotic organisms were measured using the uncoated capsules as a control.

RESULTS

Capsules were assessed visually following exposure to typical coating conditions. All capsules appeared viable and suitable for bacterial analysis.

For control capsules not exposed to any coating procedure, capsules contained on average of 2.05x1011 CFU/g (colony forming units). Following application at all coating conditions, the average CFU/g of capsules decreased (Figure 2). When exposed to heat only the average bacterial CFU/g decreased to 3.69x1010 CFU/g. Following heat and moisture application, the average bacterial CFU/g decreased to 6.65x1010 CFU/g for the low spray rate, to 9.37x1010 CFU/g for the medium spray rate and 1.56x1011 CFU/g for the high spray rate.

In terms of bacterial viability in comparison to the control capsules, exposure to heat only had the most detrimental effect with only 18% of bacterial CFU/g remaining following the coating procedure (Figure 3). Improved viability was demonstrated when both moisture and heat were applied during the coating procedure, compared to heat only. Lower decrease in bacterial viability was shown with the higher spray rate coating process. With the low spray rate 32% bacterial viability was shown, for the medium spray rate decreased to 44% and for the higher spray rate this was decreased to 76%.

CONCLUSIONS

Lactobacillus rhamnosus and Lactobacillus plantarum were formulated in liquid filled capsules. When capsules were subjected to typical coating procedures used during the application of enteric coats, bacterial viability decreased. Exposure to heat only was more detrimental to the viability of the probiotics than the application of both heat and moisture. When heat and moisture were applied in combination, higher spray rates and consequent minimisation of exposure to heat and moisture demonstrated the lowest level of viability decrease. With optimum choice of high spray rates and avoidance of excess heat application, it will be possible to minimise the loss of probiotic viability during coating to a satisfactory level.

REFERENCES