

The impact of feed temperature on the polymorphic content of spray dried lactose

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This study was undertaken in order to quantify the polymorphic content in spray dried lactose samples that were prepared from solutions at different temperatures. The α and β -lactose content in the products may influence the tableting properties of spray dried lactose. For instance, lactose samples with a high α monohydrate content are desirable for granulation formulations. Whereas different ratios of anhydrous α and β -lactose are used in direct compression formulations, Bolhuis et al (1985).

Aqueous solutions of lactose (20 g/100ml) at temperatures 25, 30, 40 and 50 °C were spray dried using a Buchi 190 spray dryer. The only variable during spray drying was the solution temperature, all other settings were unchanged. The spray dried products were assessed using X-ray diffraction (Phillips, X-Ray Diffractometer) and isothermal microcalorimetry (Thermometric AB, Sweden) and were found to have no detectable crystallinity. Gas chromatography (Carlo Erba, HRGC 5300) was used to determine the proportions of α and β lactose in the amorphous spray dried samples (Table 1).

The increase in β - content of the amorphous material with increased feed solution temperature, is due to relatively high evaporation rates in the high temperature solutions that allowed little opportunity for β - α mutarotation during the drying process.

The amorphous products were then exposed to 75%RH at 25°C in the isothermal microcalorimeter in order to produce crystalline lactose. The α and β contents in the crystallised materials were analysed by GC. There were significant differences in the α and β content between the amorphous and the crystallised material (Table 1). When the powder load in the isothermal

Feed Temp (°C)	amorphous material		crystallised lactose			
	α	β	20mg		100mg	
	α	β	α	β	α	β
25	63	37	64	36	58	42
30	59	41	63	37	73	27
40	48	52	56	44	74	26
50	43	57	55	45	71	29

Table 1: The effect of spray drier feed temperature on the α and β content in amorphous and in the consequent recrystallised lactose. (To cause crystallisation 20 or 100mg of each sample was stored at 75%RH).

microcalorimeter was 20mg crystallisation occurred quickly, hence there was a short time available for mutarotation to the α form.

However, the recrystallisation lag times for the larger powder loads (100mg) were significantly different. The high temperature feed products experienced much longer lag times, hence substantial β - α mutarotation occurred due to longer exposure to humidity.

This study has demonstrated that the α and β content in spray dried amorphous lactose and in the consequent crystallised products are significantly altered by fluctuations in spray-drying feed temperature. Furthermore, the conversion of β - α lactose will differ depending upon the conditions employed during crystallisation.

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Bolhuis et al., (1985). Drug Dev. Ind Pharm., 11, 1657-1681