COLLAGEN PASTE OBTAINED FROM PIGSKIN DEFATTED WITH SUPERCRITICAL CARBON DIOXIDE

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Introduction

There are several types of collagen pastes commonly used in the food, pharmaceutical and related industries. A collagen paste is a white suspension with a jelly aspect, obtained from denaturalisation of collagen. One of its main applications is as casing of sausages. Most of the procedures reported to obtain such collagen pastes use different mammal's skin as raw material (Checa) due to their high collagen content. In fact, collagen is the most abundant protein in mammals making up over 75% of the dry fat-free weight of the skin (Cleary, 1996). Cattle skin is most widely used to obtain collagen paste. In some cases it is combined with skin from other mammals with good results, but there is usually a strong dependence on cattle skin for this process with around 60% of cattle skin required. In order to provide an alternative to cattle skin, we propose in this work the use of pigskin, without combining it with other collagen sources, as raw material to obtain collagen paste. The main inconvenience of using pigskin for this process is its high fat content which makes it difficult to obtain consistent collagen pastes. Pigskin is only used if mixed with other sources of collagen with a lower fat content. Although there are several methods to eliminate or reduce the fat content of animal skin, we have used a mild method, supercritical fluid extraction. The solvent used was supercritical carbon dioxide (sc-CO_2). Carbon dioxide is the most frequently used supercritical solvent. The reasons are its good properties including non flammability, low critical temperature (that allows carrying out the extraction under mild operation conditions, which is very important when collagen is involved in the process), and phase equilibrium properties relatively favourable for fat extraction and later separation.

In this work, the pigskin used was obtained from experiments carried out in a pilot plant using supercritical fluids for extraction, to optimise the process to defat pigskin (Vaquero, 2004). The results showed the possibility of obtaining collagen paste from this raw material, although further studies need to optimise the yield and final operation parameters of the process, and to evaluate the consistency of the collagen paste.

Materials and Methods

Pigskin with different fat contents, ranging from 5 to 20 g of fat per gram of protein was used as source of collagen. The procedure followed to obtain the collagen paste of interest was the one patented by Checa (1) with some modifications, since the raw material used in this work did not require fat elimination that had been already done by supercritical fluid extraction (Vaquero, 2004).

This procedure consists of three consecutive stages: Firstly, around 10g of defatted pigskin, cut into pieces of around 2 cm wide and long and 5 mm thick, were immersed in a basic solution for 24 hours. The vessel was continuously stirred in a platform shaker (New Brunswick Scientific – Innova 2000). The basic aqueous solution was achieved either with NaOH or Ca $(OH)_2$ in the concentration necessary to reach a pH around 12. This treatment aims to eliminate hair residuals in the skin including the hair root.

After being washed with distilled water, the pigskin was immersed in acid solutions. In this second stage, two acid solutions were used consecutively. In the first one, acidity was achieved with concentrated acetic acid to reach a pH of 3.5 or 4. This solution produces a swelling of the pigskin samples. After being washed, the pigskin was immersed in a lactic acid solution. HCl was used to adjust the pH to between 1 or 2. This solution produces a partial denaturalisation of the collagen contained in the pigskin. Finally, the pigskin was washed and ground to obtain a homogenous paste. The consistency of the collagen paste was evaluated by extending it in a glass that was then immersed in an aqueous solution of NaCl. The film obtained was visually tested for consistency.

Results and Discussion

The evolution of the pigskin after being immersed in the different solutions seems to be important to characterise the final product.

The consistency of the samples treated with NaOH was partially lost and the solution surrounding the samples became fairly viscous while no visual changes were observed in the samples treated with $Ca(OH)_2$.

After being ground, the samples treated with NaOH formed a homogeneous white paste that could provide a fairly consistent film (Figure 1).

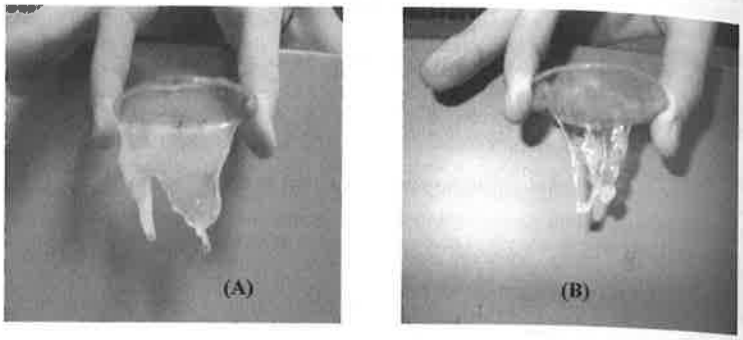

Figure 1: Collagen paste film obtained when (a) an aqueous Na(OH) solution was used and (b) when $Ca(OH)_2$ solution was used.

On the contrary, the samples treated with $Ca(OH)_2$ were difficult to grind, probably because swelling of those samples was not visually observed. After the basic and acid treatments, the collagen paste obtained from these samples also consisted of a white paste, but it was not as homogenous as the one obtained from the samples with NaOH. The effect of the fat content in the pigskin samples on the final consistency of the collagen paste was also clearly observed. The lower the initial fat content of the pigskin samples, the stronger the consistency of the film that was finally obtained from the collagen paste produced.

Conclusions

The main conclusion from the work presented, is that pigskin can be used as a unique source of collagen as long as it is defatted to a low fat content.

References

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