Summary

Pectins are a wide group of polysaccharides, which are one of the main building materials of the plant cell wall. Depending on the source of obtaining and the method of extraction, the structure of the pectin chain may differ significantly, which affects their properties and the possibility of practical application of the polysaccharide. Pectins find numerous applications, mainly in the food industry, but also in pharmaceutical, cosmetology and others, which is due to their specific properties. The most commonly used, as well as the best researched and described, are pectins obtained from citrus and apple pomace, due to the high availability of the raw material, which is a by-product of juice pressing. However, the significant impact of the source of pectin on its functional properties means that the use of a polysaccharide derived from different raw material may result in the intensification of the desired properties or the suppression of those that are less important for a given application. In addition, pectin is a naturally occurring compound that is part of the soluble fraction of dietary fiber and, having a positive effect on human health, is an additive accepted by consumers. For this reason, the possibility of using pectin for the production of innovative food products is very wide, and finding new sources that can provide a compound with the desired properties seems extremely promising.

The aim of this work was an attempt to use pectins isolated from native currant varieties for the production of gel capsules in a continuous process. The work was divided into two parts: the first part covering the characteristics of pectin obtained from redcurrant and blackcurrant, the analysis of their behaviour in aqueous solutions, as well as the assessment of the possibility of using it as a structure-forming agent in the production of gel capsules by inotropic gelation. The second part of the work was to design, optimize and prepare of a prototype device for the production of gel capsules in a continuous process and its use in practice.

The results indicate that the properties of pectin obtained from currants differ from the properties of commercially used apple pectin in terms of chain structure, water binding capacity and the nature of the formed gel. Moreover, pectin isolated from redcurrant differs from pectin obtained from blackcurrant. It was shown that the pectin chain obtained from redcurrant is characterized by high molecular weight, while being linear, with a small share of side branches. On the other hand, blackcurrant pectin has an extremely low molecular weight, and branched fragments dominate in its chain.

Differences in the structure of the chain cause different behaviour of biopolymers in aqueous solutions. Blackcurrant pectin has a stronger effect on solution viscosity, reaching the first critical concentration at the polysaccharide concentration of 0.43 $g \cdot dl^{-1}$, for blackcurrant pectin those concentration reaches 0.78 $g \cdot dl^{-1}$. Despite many differences in structure and properties, polysaccharides obtained from both sources show the ability to gel and can be used as a structure-forming factor in the production of gel capsules. Diversification of the structure and properties of pectin obtained from different sources allowed to obtain gel capsules with different mechanical properties. The prototype of a simple device proposed for the production of gel capsules in a continuous process enables the control of key parameters for the ionotropic gelling process, such as media flow rate and capsule residence time in the cross-linking solution. In addition, the prototype of the device allows to change the scale of production by increasing the dimensions or multiplying the device. All formulated research hypotheses were verified.

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