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Extended Abstract

Inulin extraction using different non-conventional techniques

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Abstract

Inulin is a fructose polysaccharide combination that is generated by plants as a source of energy. The food and pharmaceutical industries make use of its physicochemical, functional, and technical qualities. In order to get inulin, new extraction techniques are being researched since they save time, energy usage, and enhance extraction yields. Conventional extraction (CE), microwave-assisted extraction (MAE), and ultrasound-assisted extraction (UAE) were used to extract inulin from jicama (Smallanthus sonchifolius) roots and cabuya (Agave americana) meristem (UAE). To begin, CE was used to establish which non-conventional extraction approach was best for each plant. For jicama, MAE was chosen, while for cabuya, UAE was chosen. Microwave power, S:L ratio, and temperature were examined for MAE, whereas S:L ratio temperature and ultrasonic amplitude were evaluated for UAE. Soluble matter yield was the response variable in all extraction procedures. For jicama, the optimum conditions for extracting inulin by CE were 130 rpm, 75 C, 1:5 S:L, and 25 minutes; for cabuya, the optimum conditions were 80 C, 300 rpm, 1:5 S:L, and 100 minutes. The optimum MAE extraction circumstances were 90 W, 1:15 S:L, and 80 C, whereas the best UAE extraction parameters were 60 C, 1:20 S:L, and 30% ultrasonic amplitude. When extraction procedures were examined, UAE produced a larger yield (62 percent) than CE (52 percent) in the same amount of time (10 minutes); while MAE produced a greater yield (12,12 percent), 13 and 25 minutes, respectively, than CE. Finally, inulin extract was purified, dried, and characterised for each technique using FTIR, DSC, and TGA. The move from a fossil-based to a biobased economy requires the creation of biobased components from agricultural waste. Zero-waste initiatives can result in a decrease in global CO2 emissions and the closure of material cycles. Biorefineries, which are part of a well-functioning bioeconomy, are used to process leftover resources for this purpose. Chicory roots (Cichorium intybus var. foliosum) are a waste product from agriculture. These are gathered after field cultivation and kept at low temperatures for up to many months. Etiolated buds (chicons) are formed after storage in dark forcing chambers at 15–20 °C for 21 days. The chicons are sold as salad; the roots are considered agricultural waste at this stage, with only low-value use such as biogas generation. Unforced roots, which reflect the portion of rejected roots after harvest that do not meet forcing norms, are also of importance. They can also be used as a starting material for the manufacture of 5-hydroxymethylfurfural, a platform chemical (HMF). Sugars from the roots must be extracted for this purpose. Inulin and fructose are particularly important in this case. Inulin is a plant storage carbohydrate that is made up of a variety of -2-1 glycosidically linked fructose molecules. As a result, inulin is also known as polyfructose. The degree of polymerization determines the length of inulin chains (DP). It usually spans from 2 to 60, while chicory's average DP (DPa) is usually between 10 and 15, if not lower. Inulin with a DP of less than 10 is known as short-chained or low-molecular-weight inulin

It is possible to extract inulin from chicory roots using water at high temperatures. Inulin is usually taken from fresh roots since oven drying diminishes output. In a batch process at 80–90 °C, around 80–90% of the soluble sugars may be extracted in 15 minutes, or at somewhat lower temperatures in continuous processes employing pretreatments such pulsed electric fields. The extractability, on the other hand, is highly dependent on the chicory roots and the feedstock's unique surface. The sugar composition changes throughout cultivation, harvest, storage, and forcing. During cultivation, the roots contain more long-chained inulin and just a minor fraction of monosaccharides. These chains are broken down during storage and forcing, resulting in a rise in monosaccharides, mostly fructose. HMF is made from fructose after it has been dehydrated. Sucrose, glucose (through isomerization), and inulin, which must first be hydrolyzed to fructose, can all be used to make it. Higher response times and reduced yields may result as a result of this. The hydrolysis of chicory inulin may result in high fructose concentrations in the extracts, allowing for significant HMF conversion rates. The enzymes exo- and endoinulinase can be used for this. The extended reaction periods in enzymatic inulin hydrolysis would, however, constitute a significant drawback for the biorefinery process. Because enzymatic hydrolysis is also quite costly, the second approach, acid hydrolysis, is a better option. One drawback cited in the literature is that acid hydrolysis causes unattractive coloration of the hydrolysate as well as decreased sweetness due to the generation of difructose anhydrides, both of which are unimportant in this work. The research is being carried out in the context of designing a process unit for a biorefinery plant in which the extracts will be utilised to produce HMF. As a result, colour changes and sweetness are irrelevant. Previously, acid hydrolysis was carried out, mostly using Jerusalem artichoke inulin. It's said to be simple to make under mild pH and temperature conditions, and it produces the free sugars fructose, glucose, and sucrose. Two techniques for extracting and hydrolyzing sugars from chicory roots are presented in this paper As a result, colour changes and sweetness are irrelevant. Acid hydrolysis was carried out. A two-step technique, in which extraction and hydrolysis are independent process units, is contrasted to a one-step method, in which extraction and hydrolysis are combined in one process utilising water (pH 6) and

buffer solutions at two pH (2 and 4). The goal of this research is to devise a preliminary method for producing fructose-enriched extracts from chicory root in the context of an HMF-biorefinery unit.

Biography

Lorena Jaramillo awarded the Master degree in Process Engineering at the University of Applied Sciences in Hamburg-Germany in 2007, Master in Environmental Engineering at the Escuela Politécnica Nacional (EPN), Quito-Ecuador, where her undergraduate studies as Chemical Engineering were finished in 2000. She has work experience as Process Engineer developing detailed engineering for different chemical plants. Currently, she works as Professor at the EPN, teaching design plant and as the director of several research projects related to extraction of biocoumpunds from native plants as well as the sintetization of products of industrial interest.

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