

## **Assessment and extraction of starch from food waste – a review**

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### **Abstract**

Starch is a carbohydrate with a relatively complex structure which is present in plants as amylose and as amylopectin. Corn, potato, rice and wheat contain have high concentrations of starch but it is present in most plants. Except of its importance in the human diet, starch also has several industrial uses in the pharmaceutical, paper and textile industries. The multiple industrial applications can be explained by the availability of starch at low cost and its unique physicochemical conversion characteristics. The standardized starch extraction protocol separates the extraction process into two main steps; First the physical separation of the relative components and second the possible conversion (after drying) of “native starch” into “modified starch” for further industrial uses. Starch is mainly recovered by means of wet extraction processes where different extraction liquids can be utilized for the dilution of starch in the liquid phase. Other innovative methods like ultrasonically-enhanced wet extraction or microwave radiation can be applied but one of the goals of this work is the investigation of the scaling-up potential of the process and thus the economic viability is crucial. Starch extraction has been investigated by several other scientists and is gaining a lot of attention the last years. Wu<sup>1</sup> extracted starch from potatoes,

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<sup>1</sup> Wu, D., Recycle Technology for Waste Residue in Potato Starch Processing: A Review, *Procedia Environ Sci* 31; 2016: 108-112

Bancel et al.<sup>2</sup> from wheat kernels and Usman et al.<sup>3</sup> from rice. The studies that can be found in the literature have been input specific and have focused on extracting starch from one specific type of plant. Most starch extraction methods take place on a wet basis with different starch dilution liquids primarily distilled water, sodium chloride and sodium metabisulphate.

As mentioned before different extraction liquids can be utilized for the dilution of starch in the liquid phase with different dilution rates. The kinetics of starch extraction can be a useful tool in order to identify the optimal choice of dilution liquid by means of time but also by means of percentage of starch recovery. The dilution of starch in the liquids is enhanced with increased temperature. Also, heat is necessary for drying the “starch-extract” and retrieve the starch powder.

Starch has several interesting applications like the development of starch glue. Applications of starch glue as wood adhesive can be found in the literature, like Moubarik et al.<sup>4</sup>. The authors have provided a methodology for converting starch powder into wood adhesive by dissolving the starch powder into deionized water, addition of wattle tannin and hexamine and mixing with sodium hydroxide. Nonetheless, this is only one example among many. In the framework of this study an extensive review has been implemented for the assessment and extraction of starch from food waste.

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<sup>2</sup> Bancel, E., Rogniaux, H., Debiton, C., Chambon, C., and Branlard, B. Extraction and Proteome Analysis of Starch Granule-Associated Proteins in Mature Wheat Kernel (*Triticum aestivum* L.). *J. Proteome Res.* 9; 2010: 3299–3310

<sup>3</sup> Usman, M. Tahir Ishfaq, M.T., Malik, S.R., Iqbal, M. and Ishfaq, B. Alkaline Extraction of Starch from Broken Rice of Pakistan, *International Journal of Innovation and Applied Studies* 7; 2014: 146–152

<sup>4</sup> Moubarik, A., Allal, A., Pizzi, A. et al. *Eur. J. Wood Prod.* (2010) 68: 427.