The use of potato flakes in building materials and the effect of the amylose/amylopectin ratio on its firmness

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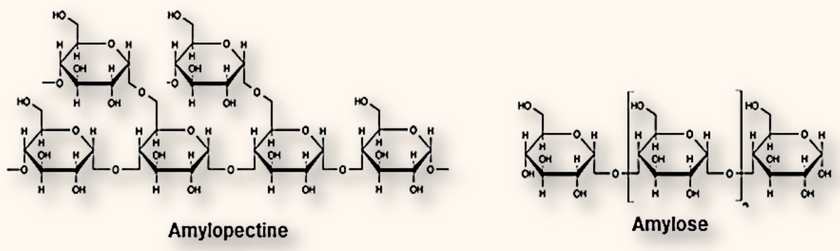
Introduction

In this research project, the usability of potato waste streams as building material is studied. The focus is on the possibility of replacing sand with different types and proportions of glass waste.

Starch is a polysaccharide that consists out of two different compounds: amylopectin and amylose. In this project, the amylose content in different starch resources is measured. This amylose/amylopectin ratio affects the gelatinisation of the starch present in potato flakes and therefore the firmness of the building material based on these potato flakes. Higher levels of amylopectin will promote gelation, which is not desirable. The amylose content was determined for potato flakes, native rice starch and maïzena. The total starch content was also determined for the potato flakes.

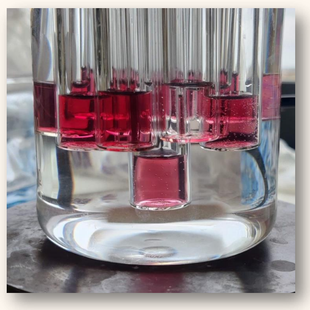


Source figure; Admin, A. (2021, 20 juli). Dieet met resistent zetmeel. Darmklachten.nl. https://www.darmklachten.nl/resistent-zetmeel/

Materials and methods

The test samples are formed by mixing water with potato flakes, sand and glass in specific quantities. This mixture is placed in a mold and pressed in a specific order with the pressing machine alternated by being heated in a microwave oven. Finally, the samples are removed from the mold and set aside to cure for three weeks.

An accredited AOAC-method, prepared by the company Megazyme was used to determine the total starch content. In this, the starch is completely broken down by enzymes into glucose units. These glucose units were then oxidised to gluconate, forming equimolar amounts of hydrogen peroxide. This hydrogen peroxide then reacted with the GOPOD-reagent, yielding a stable colour reagent. By determining the absorbance of this mixture with a spectrophotometer, the starch content could be determined. A similar method was used for the amylose determination, with the difference that the amylopectin was first precipitated and removed from the solution.

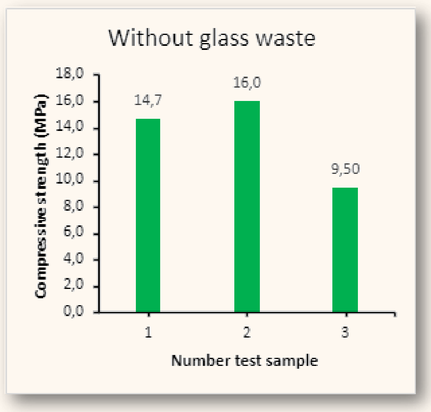


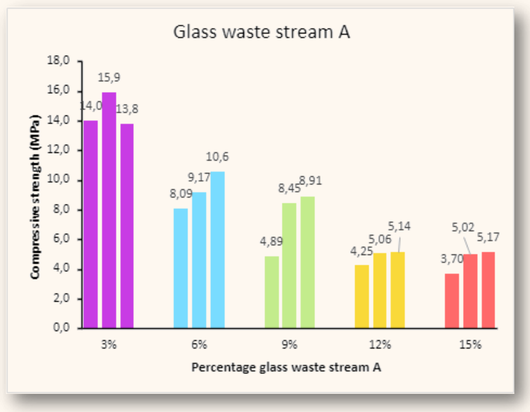
Results and discussion

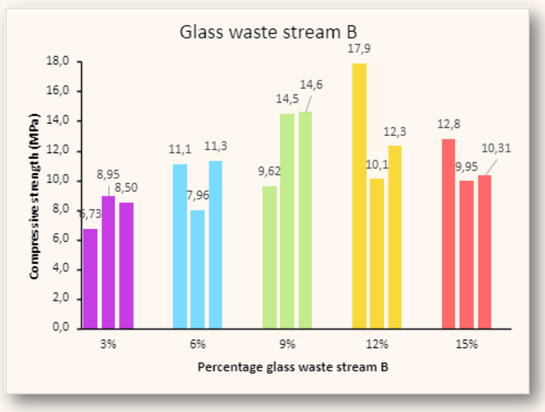
The measured absorbance of the different samples for the total starch content and amylose content were converted to a mass percentage.

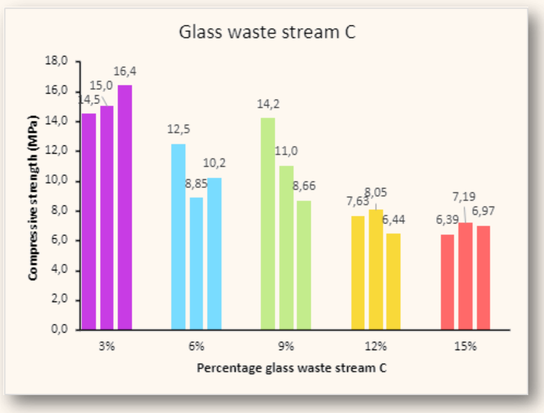
A pressure measurement bench was used to measure the test samples. This machine measures the compressive strength, which is expressed in `MPa´.

Sample	Amylose w%	Total starch
Potato flakes	12,05 - 23,24%	63,97 ± 1,10%
Native rice starch	25,02%	
Maïzena	21,33%	









Conclusion

The starch quantities in the samples of potato flakes are with the mean percentage of 63,97 ± 1,10%, corresponding with their value in literature. These values being between 60% and 80%. The amylose content of these samples of potato flakes was different, depending on which day was measured. The reason for this was the grain size of the sample, with a better measurement associated with a finer grain size. The mean amylose content on the first measurement is 14,04% and 23,24% on the second measurement.

The amylose content of native rice starch was determined at a value of 25,02%, the corn starch amount to 21,33%.

The compressive strength of the test samples vary between every glass flow. We can conclude that flow A and C are more alike where a 3% glass flow isn't disturbing the strength of the samples. Flow B on the other hand is more deployable for processing in building material when used in a fraction between 9 and 12%, which will increase the strength by 10%.

Promotor research: Geert Dehaen and Paulien Roosen
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