



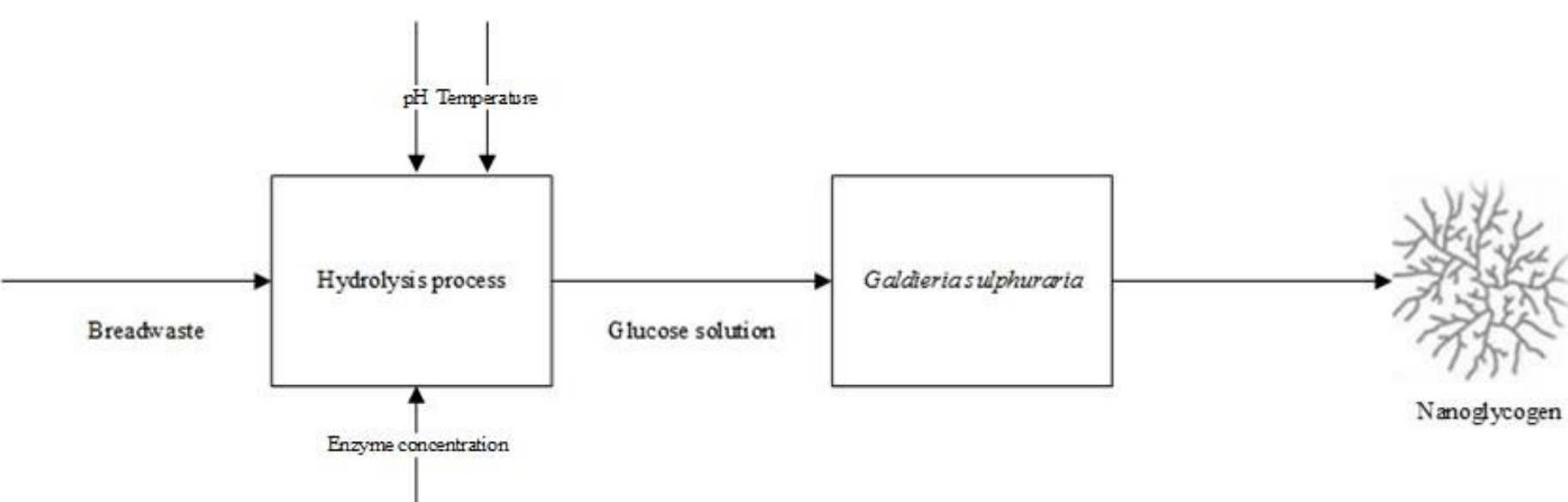
# Bread waste vs. Glycerol

As a substrate for the *Galdieria sulphuraria* in the production of Nanoglycogen

## Introduction

Due to unsustainable economic growth, which relies on the exploitation of limited fossil resources, there is searched for new biomass resources. It appears that algae are a good alternative to terrestrial crops due to the high biomass productivity, without using fertile agricultural land. Algae can be used directly as a food source, or as a source for biodiesel. Some algae produce high value end products like the *Galdieria sulphuraria* which produces Nanoglycogen. In order to commercialize Nanoglycogen research is done on different growing substrates. It is known that *G. sulphuraria* can grow on glycerol. Due to an inspiring article of de Sloth et al., bread waste arises as a new promising substrate and the following research question arises.

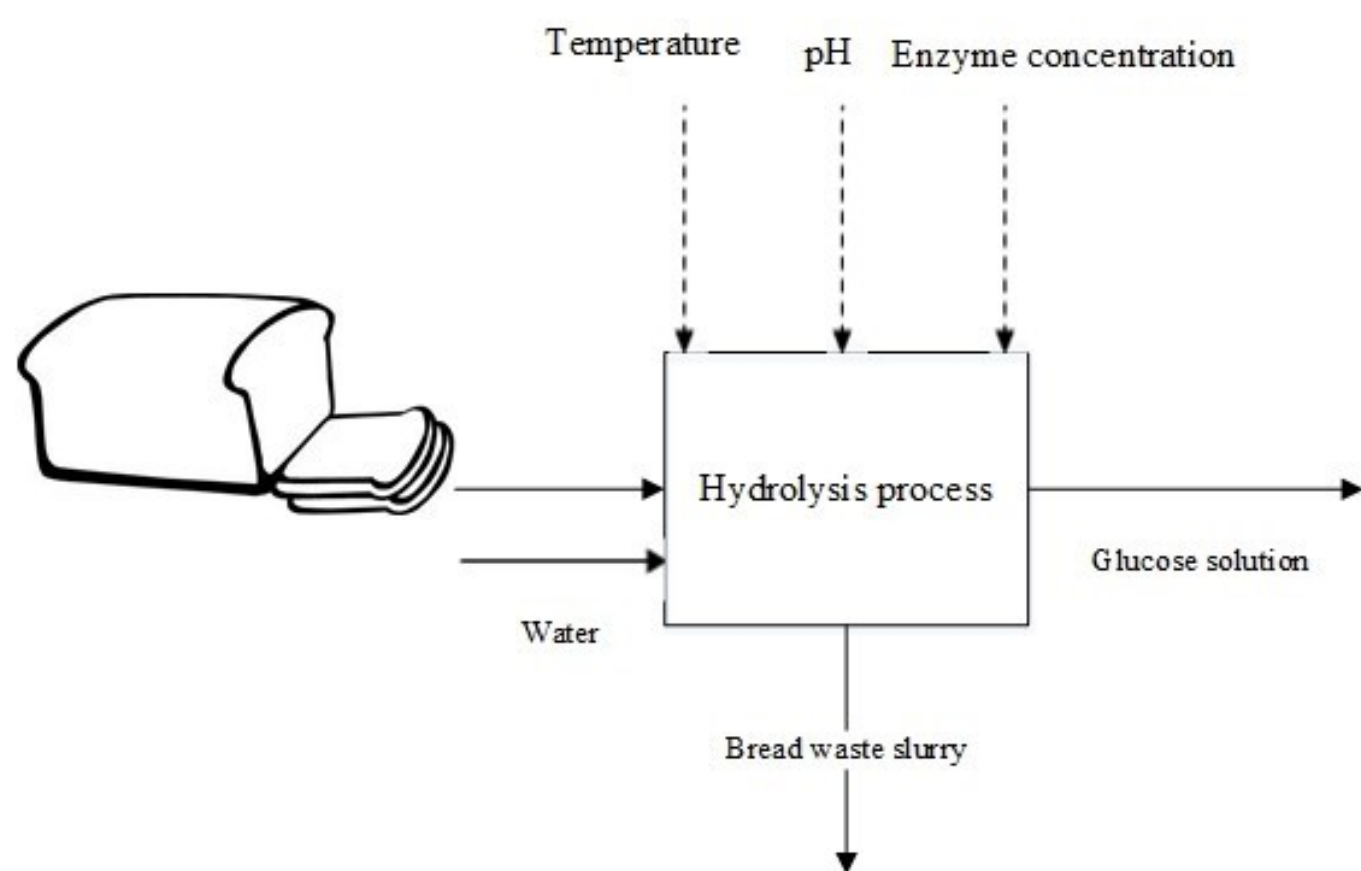
**Can on industrial scale hydrolyzed bread waste, used as a substrate for the *G. sulphuraria*, compete in an economic way with glycerol in the production of Nanoglycogen?**



## Lab scale experiments

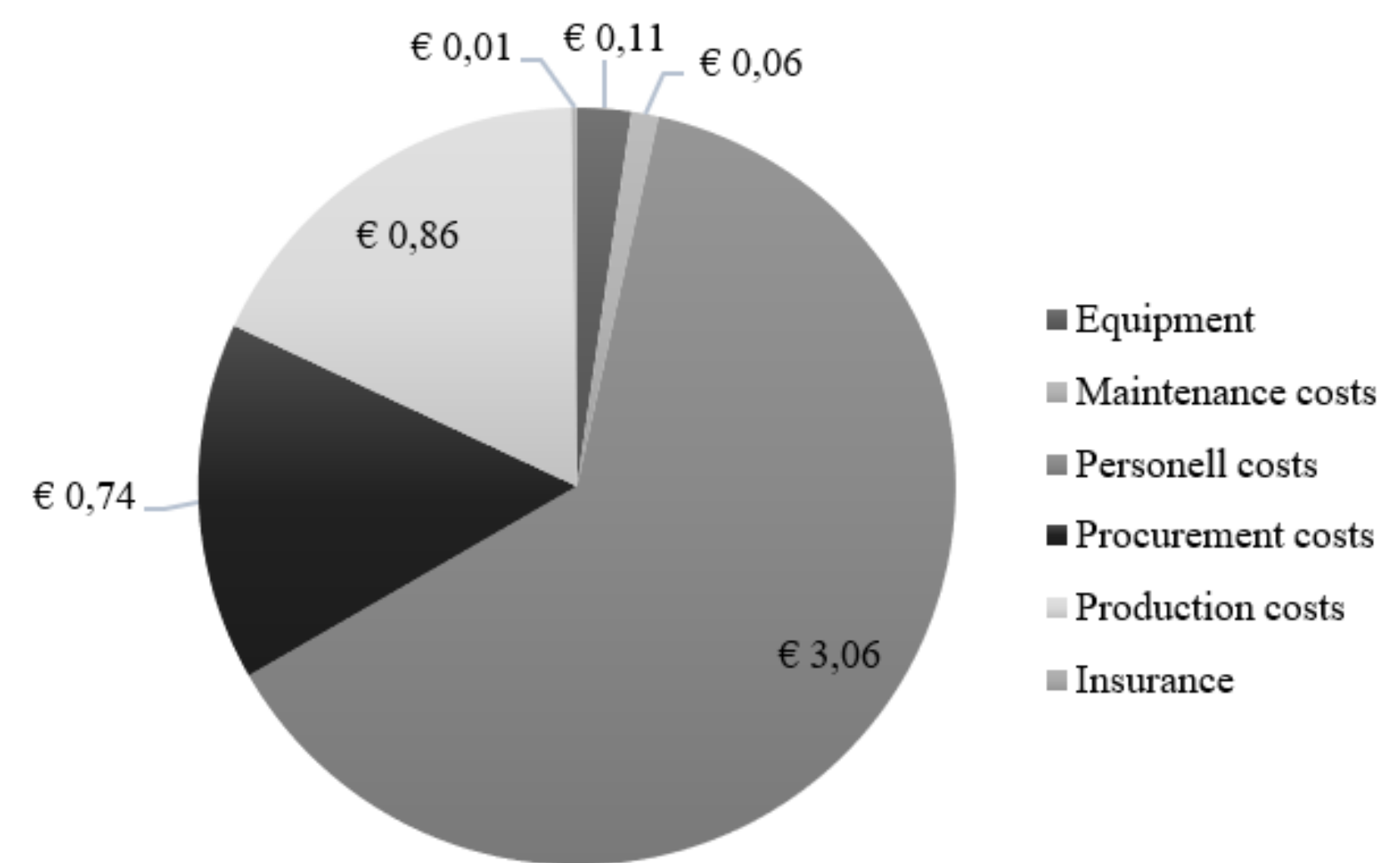
The influence of the variables enzyme concentration ( $C_e$ ), Reaction time (s) and temperature (T) on the hydrolysis process of bread waste were investigated during experiments.

$$\text{Glucose g/L} = 5,2 + 0,000263 * T + 0,144 * t + 0,067 * C_e$$



## Cost analysis

The total price found for 1 kg glucose is €4.83. The price for 1 kg crude glycerol is €0.11.



## Conclusion

- Bread waste can not compete with glycerol as substrate for the *Galdieria sulphuraria*. The substrate is 43 times more expensive than glycerol.
- The *G. sulphuraria* can grow on bread waste.

## Information

Simone van Eekert | S2896311 | s.j.m.van.eekert@student.rug.nl

Bachelor integration project

1st supervisor: Prof. M.J.E.C van der Maarel

2nd supervisor: dr.ing H. Kloosterman

## Optimum Industrial design

During the design process it was aimed to develop an industrial design for the hydrolysis process of bread waste and to minimize the variable production costs per kg produced glucose.

Variable costs =  
 $\frac{\text{Estimated kg glucose produced}}{\text{Energy costs} + \text{material costs}}$

