HETEROTROPHIC CULTIVATION OF EUGLENA GRACILIS IN STIRRED TANK BIOREACTOR: A PROMISING BIOPROCESS FOR SUSTAINABLE PARAMYLON PRODUCTION

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INTRODUCTION

Microalgae *Euglena gracilis* generate and accumulate valuable intracellular components like vitamins, pigments and carbohydrates. One of this carbohydrates is paramylon. Investigations reviled exceptional immune system buster effect of paramylon. Therefore, paramylon has high commercial value and can be found in many food-supplements and drugs. In this study, complex medium with corn steep solid (CSS) and various bioreactor processes (batch, fed batch, semi-continuous and continuous) were performed in order to maximize paramylon production in microalgae *Euglena gracilis*.

Fig. 1. Light Microscope view of *Euglena gracilis*.

RESULTS

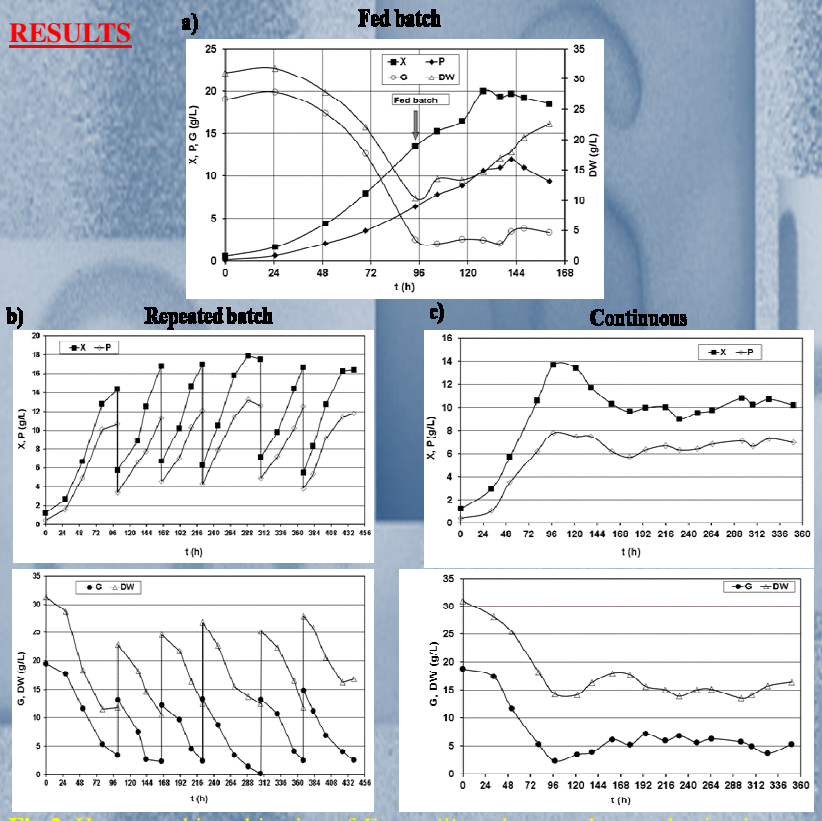

Fig 2. Heterotrophic cultivation of *E. gracilis* and paramylon production in stirred tank bioreactor by the different bioprocesses modes: a) fed batch; b) repeated batch; c) continuous.

DISSCUSION

In order to summarize results, the comparison of different cultivation modes was performed. Results that were achieved on complex medium with 20 g/L glucose and 25 g/L CSS were compared separately in the terms of bioprocess modes efficiency (Table 1). Maximum *E. gracilis* biomass (X_M=19.4 g/L) and paramylon (P_M=17.5 g/L) concentrations, show that the most favourable bioprocess mode regarding highest *E. gracilis* biomass concentration and paramylon accumulation is fed batch process. As for the paramylon and biomass productivity, the most favourable bioprocess mode is continuous process, with biomass productivity (Pr_X=0.284 g/Lh) and paramylon productivity (Pr_P=0.189 g/Lh). Productivities are in the range with previously optimised fed batch bioprocesses for paramylon production in STR on the complex medium with potato liquor. Obstacles in the continuous bioprocess mode is lower biomass concentration (X_M=10,67 g/L) and relatively high concentration of glucose (G) and soluble dry weight (DW) content in the outflow (Fig 2c). Increase of medium components in outflow and relatively low biomass concentration has negative impact on the downstream processes and paramylon purification. However, continuous cultivation can by easy prolonged and nature of the continuous operation reduce time and the costs for the upstream processes.

Bioprocess mode	t_M h	X_M g/L	P_M g/L	$Y_{P/X}$ g/g	Pr_X g/(L h)	Pr_P g/(L h)
Fed batch	154	19.4	17.5	0.90	0.126	0.113
Repeated batch	446	17.9(Σ99.4)	13.2(Σ71.2)	0.72	0.222	0.160
Continuous	288	10.5	7.0	0.67	0.284	0.189

Table 1. Bioprocess efficiency parameters calculated during heterotrophic cultivation of *E. gracilis* by the different bioprocesses modes and complex medium containing 25 g/L of CSS and 20 g/L of glucose.

CONCLUSIONS

Batch cultivation of *E. gracilis* and paramylon production can be successfully conducted in stirred tank bioreactor on the complex medium consisting of (20 g/L glucose and 25 g/L CSS) as a substitute for chemically defined Hutner medium. According the efficiency parameters calculation most efficient bioprocess mode for *E. gracilis* cultivation and paramylon production are fed batch and continuous mode. On the basis of the productivity calculation results it is obvious that continuous mode of bioprocess has great potential for industrial production of paramylon by *E. gracilis*.

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