

## ABSTRACT

The present study deals with the ultrasonic induction of microbial pyruvate decarboxylase for L-phenylacetylcarbinol synthesis and *in silico* mechanistic analysis. *Saccharomyces cerevisiae* FNY-1 and *Rhizopus oligosporus* ISL-6 were selected as the test organisms. Optimum PDC activity by wild type *S. cerevisiae* FNY-1 i.e.  $0.79 \pm 0.03$  U/ml was recorded after 4 h of incubation at 100  $\mu$ l of benzaldehyde conc., 5% glucose conc., 4.5 pH and 6% of inoculum size. While L-PAC conc. was optimized with *R. oligosporus* ISL-6 and was recorded to be  $4.8 \pm 0.2$  g/l. Both the cultures and cell free supernatants of FNY-1 and ISL-6 were treated with ultrasonic irradiation and effect of several parameters such as ultrasonic exposure time, ultrasonic dosage and distance of ultrasonic treatment was analyzed for the optimal production of PDC and L-PAC. A 28.8% rise in PDC activity by frozen cells of *S. cerevisiae* FNY-1 was recorded upon ultrasonic induction compared to the frozen cells of *R. oligosporus* ISL-6 which showed a 17.1% rise in PDC activity. Besides that, optimum L-PAC conc. i.e. 4.8 g/l was recorded by frozen cells of *R. oligosporus* ISL-6. The cultures of both microorganisms were further ultra-frozen and were compared with the frozen cultures for optimal PDC and L-PAC synthesis. Optimization was carried out against temperature, buffer pH and activity assay incubation time. Ultra-frozen samples of both test organisms demonstrated a significant rise in PDC activity as well as L-PAC conc. However, PDC activity values remained slight high with *S. cerevisiae* FNY-1 i.e.  $1.65 \pm 0.03$  U/ml and L-PAC yield was optimized with ultrafrozen cells of *R. oligosporus* ISL-6 and was recorded to be  $6.2 \pm 0.6$  g/l. *In silico* study revealed the presence of three chains in the structure of PDC and it showed the involvement of cysteine, glycine, aspartic acid, serine, histidine and alanine in active site forming a complex with pyruvate. Overall this study concluded that ultrafrozen cells of *S. cerevisiae* FNY-1 and *R. oligosporus* ISL-6 exhibited maximum PDC activity and L-PAC yield respectively upon ultrasonic irradiation.