Junior Science Communications
Faculty of Applied Sciences, UiTM Shah Alam
https://journal.uitm.edu.my/ojs/index.php/JSC

E-ISSN 2637-0689
Vol 43 2025

Colloquium on Applied Sciences 2 2024
8-14 July 2024, Faculty of Applied Sciences, UiTM Shah Alam, Malaysia

Potential in Degradation of Benzo[a]pyrene (BaP) and Naphthalene (Nap) by *Lactobacillus casei* Strain Shirota

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Structured Abstract

Background: Consuming food contaminated with polycyclic aromatic hydrocarbons (PAHs) can significantly increase the risk of developing cancer in the human body. As the consumption of processed foods containing PAHs compounds is becoming more common among people, therefore the potential to the exposure of these carcinogens is increasing. The beneficial effect of probiotic strains in detoxifying various types of PAHs compound has been studied by most researchers. The inhibitory activity against carcinogens of probiotics including lactic acid bacteria (LAB) can aid in the decontamination of PAHs through several mechanisms such as increasing activities of antioxidative enzymes, decreasing pH of the intestinal, conversion carcinogens into less toxic compounds and the physical interactions between the binding of PAHs compounds and the peptidoglycans of LABs. Therefore, the primary goal of this study was to analyse *Lactobacillus casei* strain Shirota growth in a medium with PAH presence, as well as to determine PAHs reduction after degradation process.

Methods: *L. casei* strain Shirota was used to biodegrade PAHs, including benzo[a]pyrene (BaP) and naphthalene (Nap). Specifically, the degradation process was monitored at 0, 2, 4, 6, and 24 hours of incubation. The growth and metabolic response of *L. casei* strain Shirota in the presence of PAHs was assessed through turbidity analysis, pH measurement, and colony-forming unit (CFU) counts. Furthermore, the quantification of the remaining concentrations of BaP and Nap post-degradation was precisely measured using GC-MS analysis. One-way analysis of variance (ANOVA) and Tukey's test were conducted, to ensure high correlation and model fit with the experimental data.

Results: This study shows that *L. casei* strain Shirota was successfully degrade BaP and Nap. The significant growth of *L. casei* strain Shirota in the MRS medium shows positively in the increase of turbidity, pH remained in the acidic medium ranging in pH 6 and the milky white and circular shape colonies growth respectively after the 24 hours of incubation period. Corresponding to the growth of *L. casei* strain Shirota, the percentage of both PAHs shows significant reductions after the incubation hour. Specifically, BaP concentration level was reduced by 52.20%, while Nap concentrations level was decreased by 55.24%.

Conclusion: In conclusion, the findings of this study indicated that the evaluated bacteria, *L. casei* strain Shirota can degrade high molecular weight of PAHs such as BaP and Nap. Therefore, the *L. casei* strain Shirota as a probiotic may be a promising strategy for reducing the levels of PAHs in food products. Thus, the detoxification mechanism by probiotics can adhere to the innovative bioremediation strategies for PAH-contaminated environments, improving public health and maintain environmental sustainability.

Keywords: *L. casei* strain Shirota, probiotics, benzo[a]pyrene, naphthalene, PAHs degradation

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