

IN VITRO ANTI-CANCER ACTIVITIES OF *Pinus merkusii* JUNGH. ET DE VRIESE BARK EXTRACT NANOPARTICLES ON HELA CELL LINE

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ABSTRACT

This research aimed to investigate the anti-cancer activities of *Pinus merkusii* (Jungh. et de Vriese) bark extract nanoparticles on human cervical cancer cell line (HeLa). *Pinus merkusii* bark extract nanoparticles were prepared using ionotropic gelation method, then were characterized using *particle size analyzer* and screened for the phytochemical contents. The anti-cancer activities of *Pinus merkusii* bark extract nanoparticles against HeLa cells were evaluated for the cytotoxicity effect based on MTT assay, the cell cycle arrest by flowcytometry, apoptosis induction using Annexin V/PI binding methods, and, further, the p53 and caspase-9 expression with the help of immunocytochemistry staining. The results showed that *Pinus merkusii* bark extract nanoparticles have a size of 394,3 nm and phytochemical contents in the form of alkaloids, terpenoids, steroids, and saponins. Meanwhile, the *Pinus merkusii* bark extract nanoparticles were found to be cytotoxic to HeLa cells with an IC₅₀ of 384,10 µg/mL. *Pinus merkusii* bark extract nanoparticles also caused cell cycle arrest at the G₀/G₁ phase and induced early apoptosis in the HeLa cells. Moreover, increased expression of p53 and caspase-9 was also observed. The results displayed a significant anti-cancer effect through cell cycle arrest and apoptosis induction in HeLa cells, suggesting that *Pinus merkusii* bark extract nanoparticles might have therapeutic potential for cervical cancer.

Keywords: HeLa, *Pinus merkusii*, nanoparticles, cytotoxicity, apoptosis