Anti-Cancer Effects of Novel Morphologies of 2,3-Dichloro-1,4-Naphthoquinone Nano-Particles in MCF7 Breast Cancer Cells

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Breast cancer is the most common diagnosed cancer in women worldwide. Despite the success of surgery to treat early stages of breast cancer, later stages often require systemic chemotherapy with significantly lower cure rates, making breast cancer the leading cause of cancer death in women. Therefore, there is a constant need for new effective therapies. In this study, I developed three novel morphologies of 2,3-dichloro-1,4-naphthoquinone using anti-solvent precipitation technique with three different solvents, toluene, acetone and tetrahydrofuran, respectively. The three novel compounds were designed as nanoparticles with different morphologies and sizes as viewed under scanning electron microscopy. This method resulted in the assembly of nanosheet, nanoblock, and microblock forms. MCF7 breast cancer cells were treated by the three morphologies using the following concentrations 5, 10, 20, 30, 40, 50μM, three times per concentration, and were compared to the untreated controls. The cytotoxic effect of each morphology was tested using MTT cell viability assay. All three morphologies were able to significantly reduce the cell viability compared to controls (at 50 μM: nanosheet by 99%, $p < 0.001$; nanoblock by 91.5%, $p < 0.01$; microblock by 81%, $p < 0.01$). The half maximal effective concentration (EC50) for nanosheets, nanoblocks, and microblocks were 12.37, 15.62, 22.87 μM respectively. The low EC50 of nanosheets indicates that it is the most effective preparation among the three compounds. The results indicate the three morphologies of 2,3-dichloro-1,4-naphthoquinone nanoparticles as novel therapeutic agents have promising anti-cancer effects, particularly the nanosheet form.

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