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Co-delivery of Curcumin and Bioperine via PLGA Nanoparticles to Prevent Atherosclerotic Foam Cell Formation

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Abstract

Cholesterol-rich arterial plaques characterize atherosclerosis, a significant cause of heart disease. Arterial plaques upregulate inflammatory cytokines secreted by the macrophages that finally become cholesterol-laden foam cells. Nutraceuticals have received attention over the years, demonstrating potential benefits towards treating and preventing cardiovascular diseases (CVD), including atherosclerosis. Curcumin, a potent polyphenol present in Curcuma longa, showed remarkable anti-atherosclerotic activity via anti-inflammatory and anti-oxidative properties. The bioavailability and low water solubility of curcumin limit its clinical translational purposes. These issues can be circumvented effectively by nano-drug delivery systems that can target atherosclerotic plaque sites. In this work, we chose to use curcumin and a natural bioenhancer called Bioperine (derived from Piper nigrum) inside a polymeric nano-drug delivery system for targeting atherosclerotic plaque sites. We selected two different ratios of curcumin: Bioperine to study its comparative effect on the inhibition of oxidized low-density lipoprotein (Ox-LDL) induced foam cell formation and investigated the therapeutic efficacy in THP-1 monocyte-derived macrophages via different in vitro cell studies. Our studies demonstrated that Bioperine administration alongside curcumin via PLGA nanoparticles (NPs) imparts a reduction in macrophage-mediated foam cell formation, relative cholesterol content, and the inflammatory pathways when administered as preventive medicine, highlighting the importance of natural-based compounds towards the therapeutic intervention against the atherosclerotic activity.

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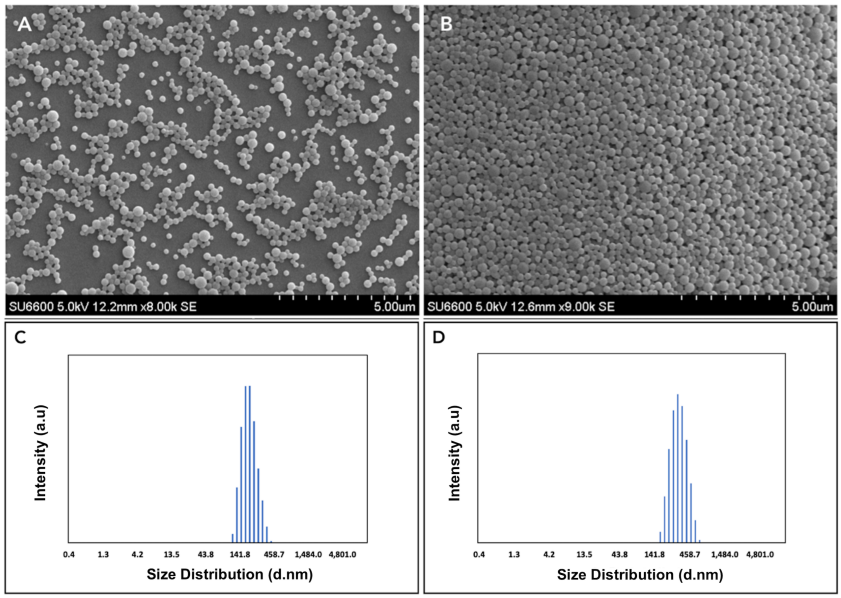

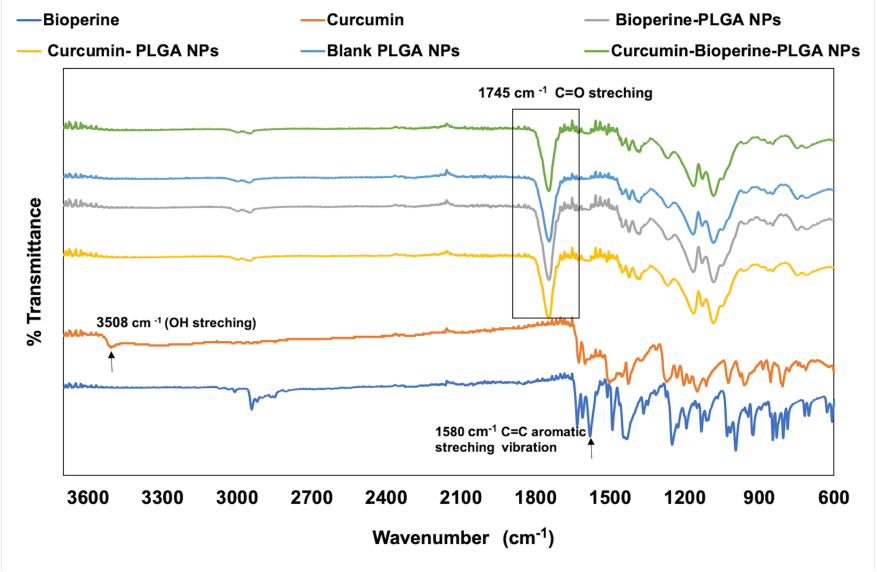

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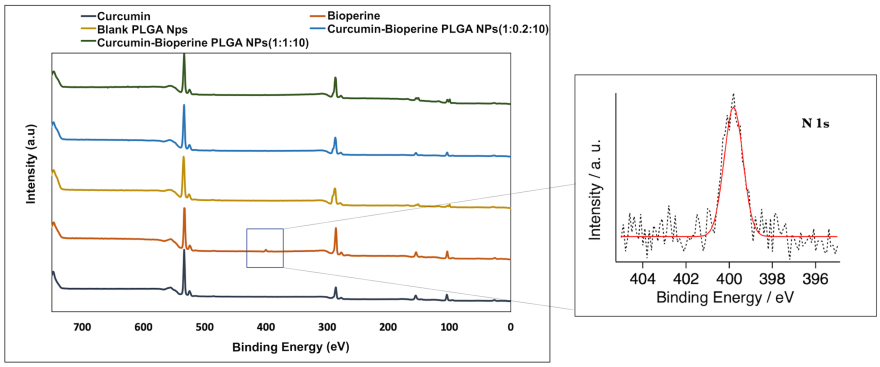

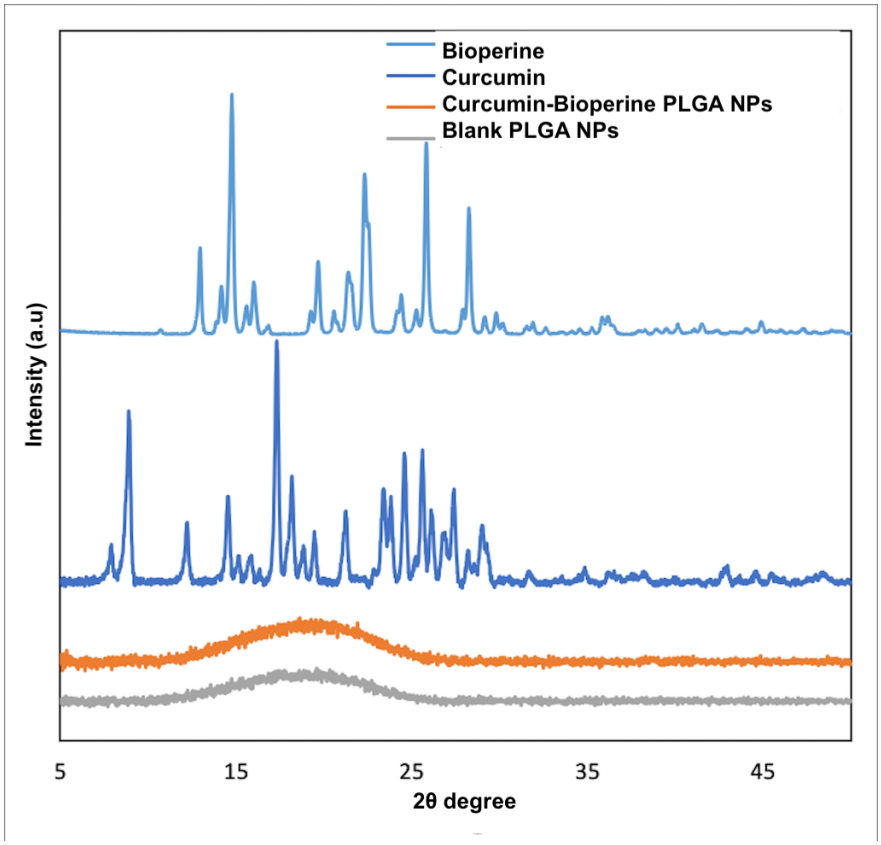

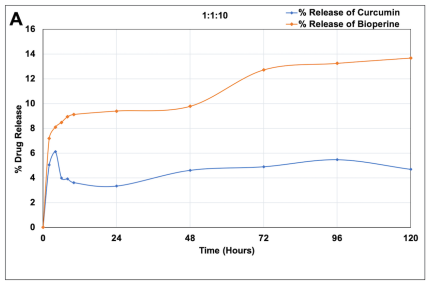

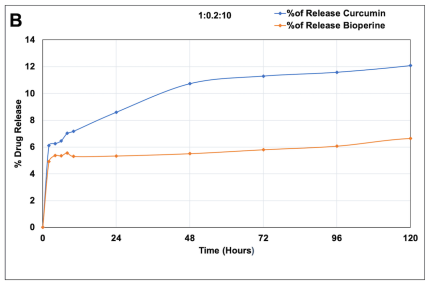

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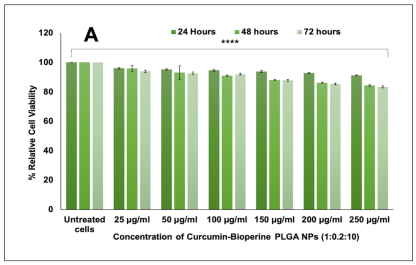

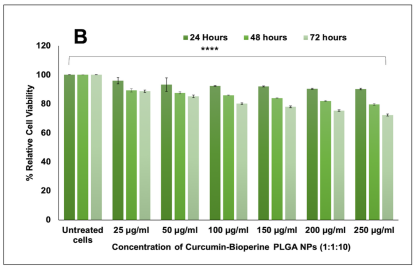

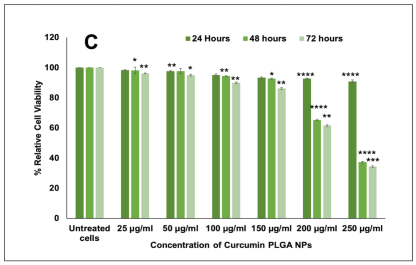

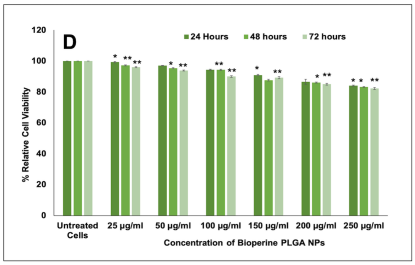

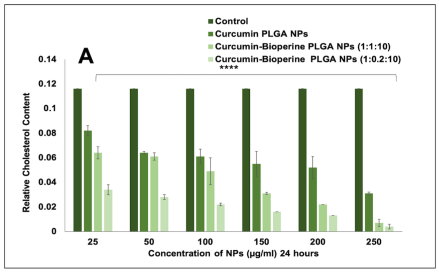

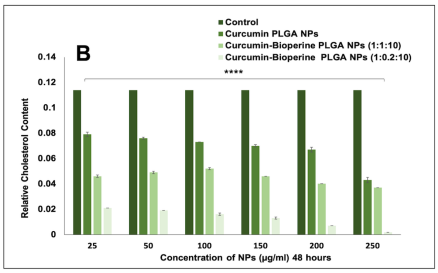

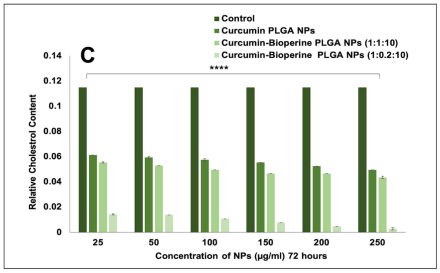

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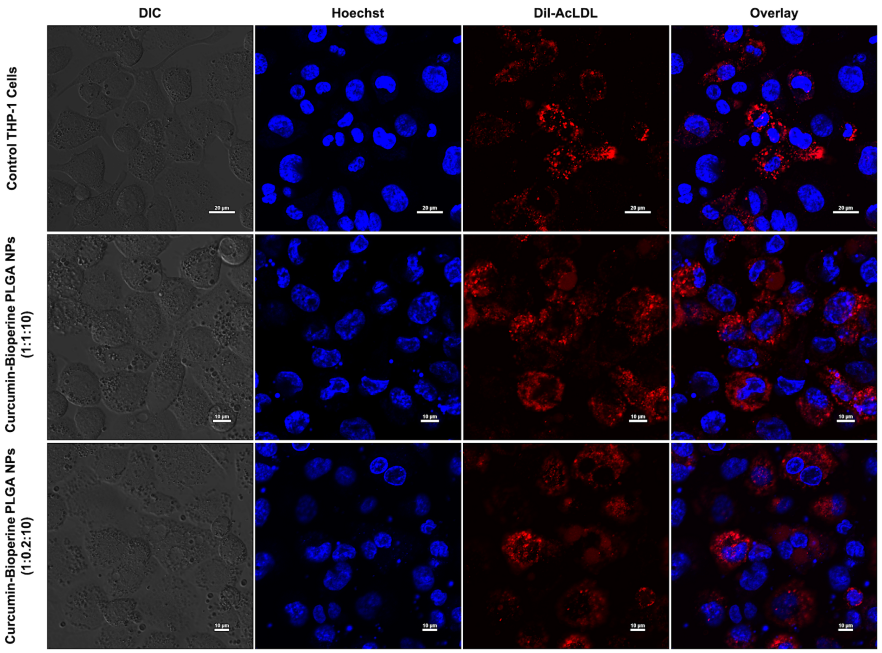

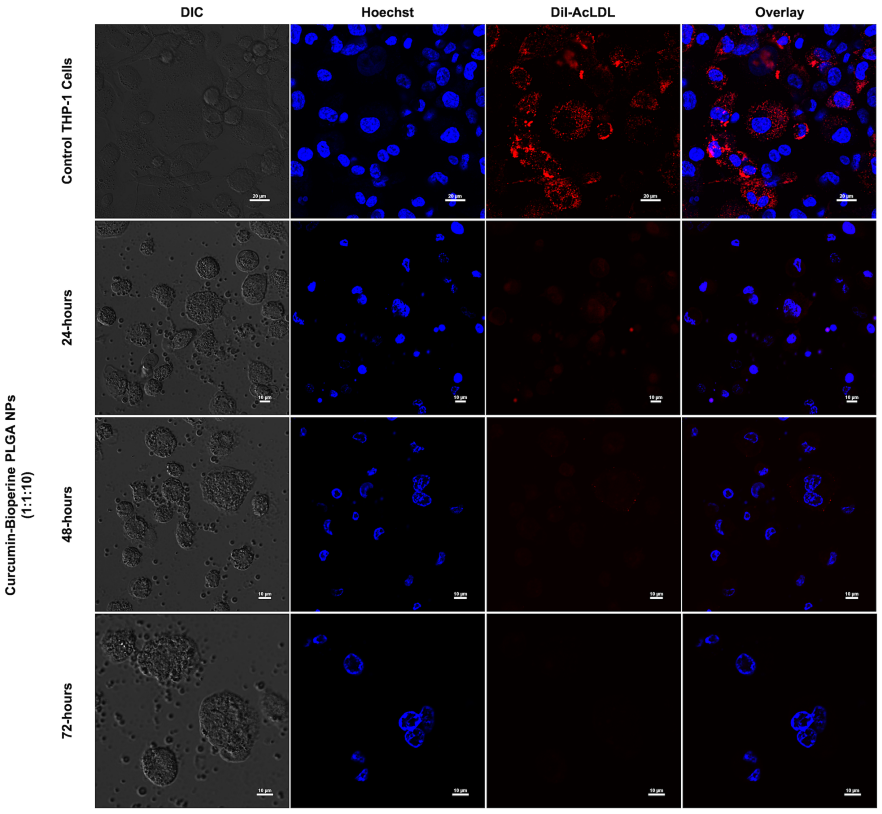

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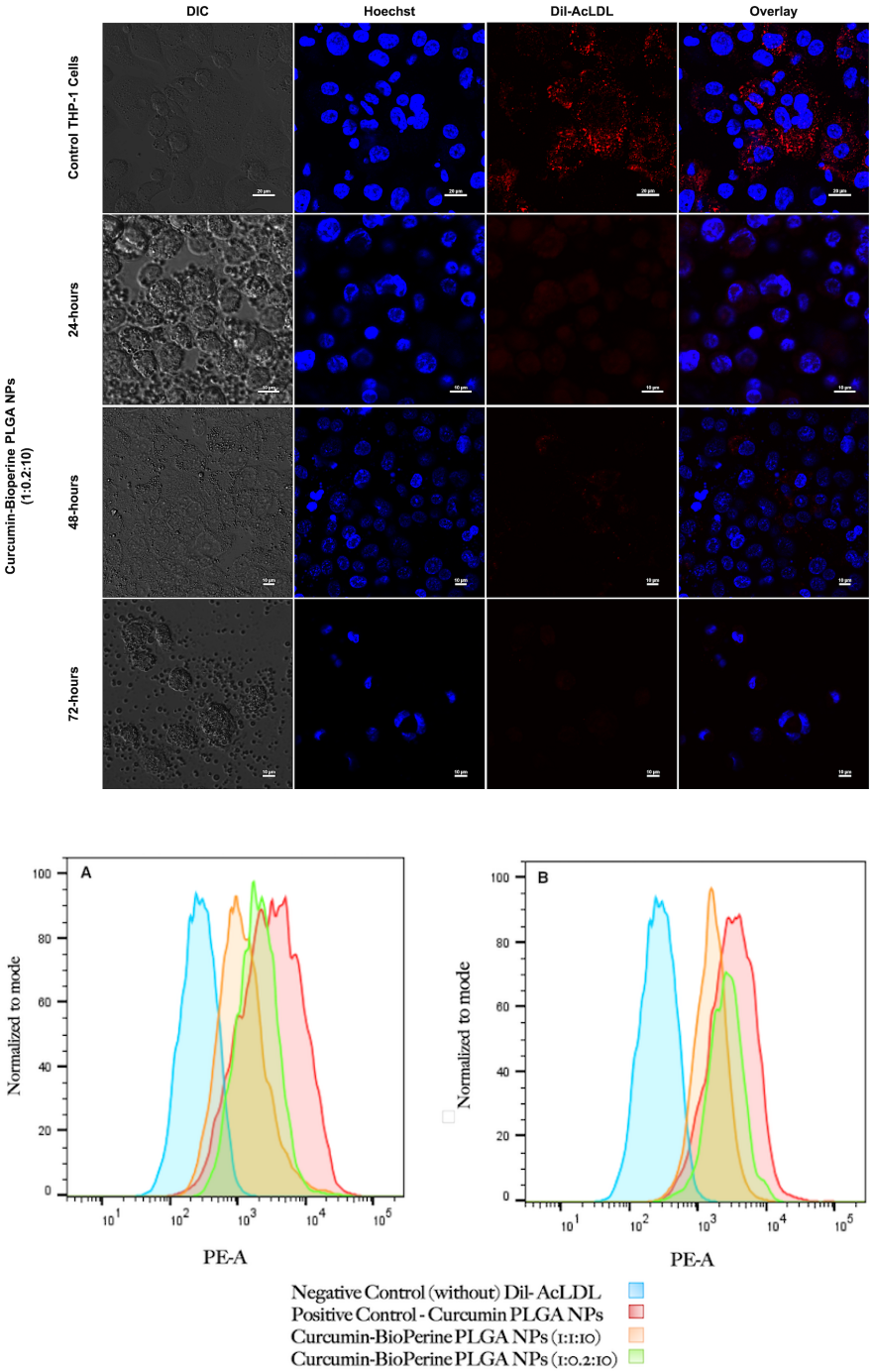

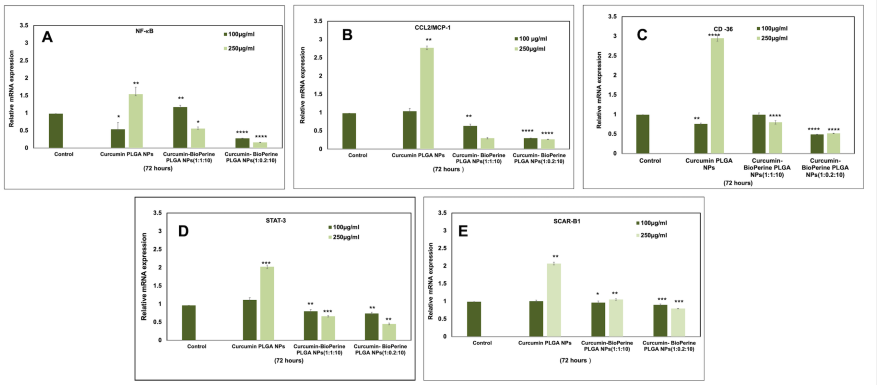

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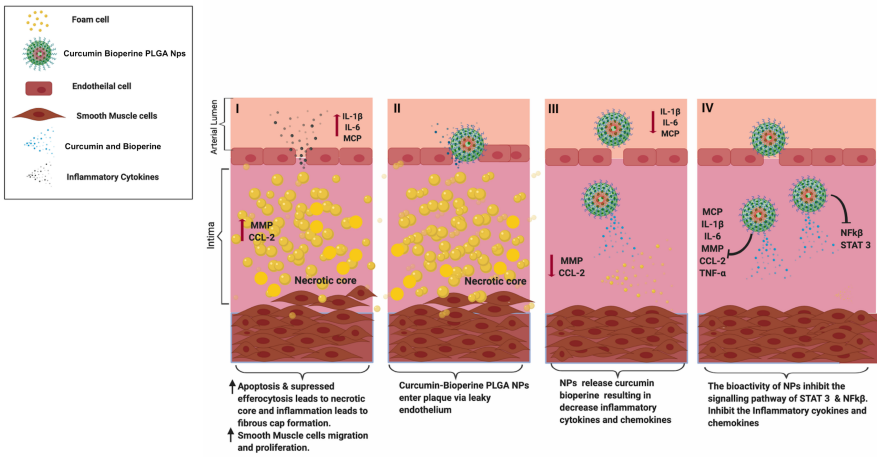

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