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ORIGINAL ARTICLE

Optimization of ultraviolet ozone treatment process for improvement of polycaprolactone (PCL) microcarrier performance

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Abstract Growing cells on microcarriers may have overcome the limitation of conventional cell culture system. However, the surface functionality of certain polymeric microcarriers for effective cell attachment and growth remains a challenge. Polycaprolactone (PCL), a biodegradable polymer has received considerable attention due to its good mechanical properties and degradation rate. The drawback is the non-polar hydrocarbon moiety which makes it not readily suitable for cell attachment. This report concerns the modification of PCL microcarrier surface (introduction of functional oxygen groups) using ultraviolet irradiation and ozone (UV/O_3) system and investigation of the effects of ozone concentration, the amount of PCL and exposure time; where the optimum conditions were found to be at 60,110.52 ppm, 5.5 g PCL and 60 min, respectively. The optimum concentration of carboxyl group (COOH) absorbed on the surface was 1495.92 nmol/g and the amount of gelatin immobilized was 320 ± 0.9 μg/g on UV/O_3 treated microcarriers as compared to the untreated (26.83 ± 3 μg/g) microcarriers. The absorption of functional oxygen groups on the surface and the immobilized gelatin was confirmed with the attenuated total reflectance Fourier transformed infrared spectroscopy (ATR-FTIR) and the enhancement of hydrophilicity of the surface was confirmed using water contact angle measurement which decreased (86.93°–49.34°) after UV/O_3 treatment and subsequently after immobilization of gelatin. The attachment and growth kinetics for HaCaT skin keratinocyte cells showed that adhesion occurred much more rapidly for oxidized surfaces and gelatin immobilized surface as compared to untreated PCL.

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