Optimisation of ported yield of hemi-spherical micro-particles for soft tissue augmentation

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Introduction

The use of biodegradable polymers in temporary surgical and pharmacological applications has become a prominent part of polymer research [1]. **Poly(ε-caprolactone) (PCL) is widely studied for tissue engineering applications** due to its relatively suitable degradation period and biocompatibility [2].

Micro-porous particles are useful in **soft-tissue bulking** due to their relatively large surface area, low density and high degree of porosity [3]. **In this study, we have developed ported porous PCL particles for** soft-tissue bulking, using an oil-in-water emulsion with an internal bicarbonate phase which evolves carbon dioxide gas on reaction with acetic acid thereby producing ports in the structure.

It is postulated that micro-porous ported PCL particles:

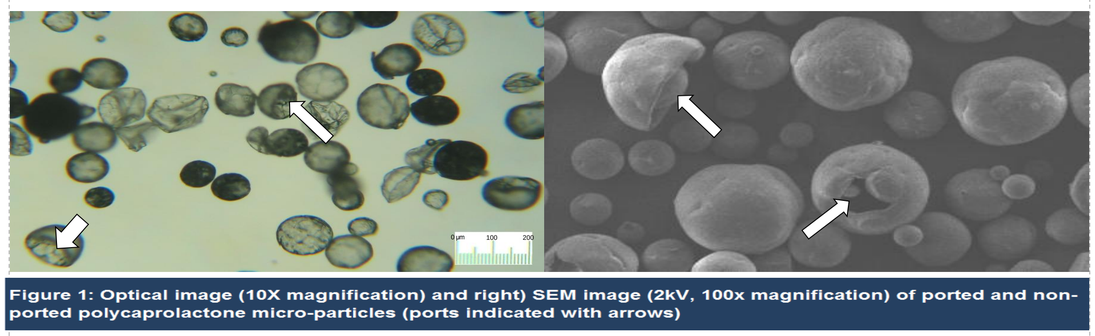

Figure 1: Optical image (10X magnification) and right) SEM image (2kV, 100x magnification) of ported and non-ported polycaprolactone micro-particles (ports indicated with arrows)

Problem Statement

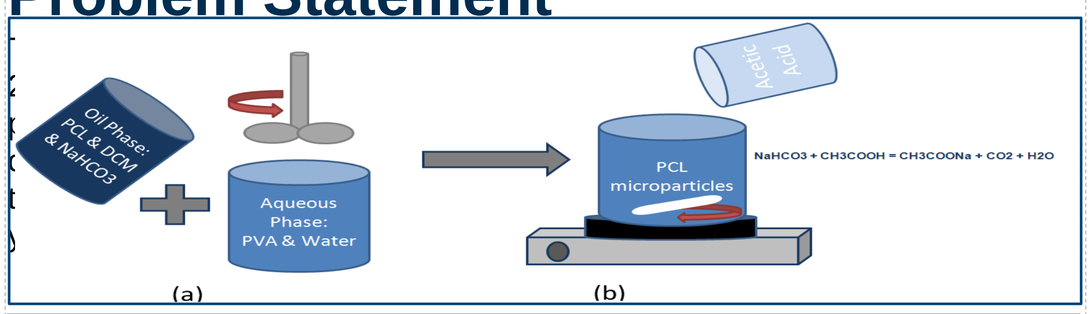

Figure 2: Schematic representation of port-forming process (a) combination of phases while homogenising and (b) acid addition during solvent evaporation on a magnetic stirrer plate

Approach

Particles are manufactured via an oil in water emulsification process.

The parameters investigated (in triplicate) are given below:

	% PVA	Porogen (g)	Acetic Acid (g)	Stirring rate (rpm)
Standard	1	3	2.14	500
Level 1	0.33	3.25	2.32	
Level 2	0.66	3.50	2.50	
Level 3	1.33	3.75	2.68	600

Results

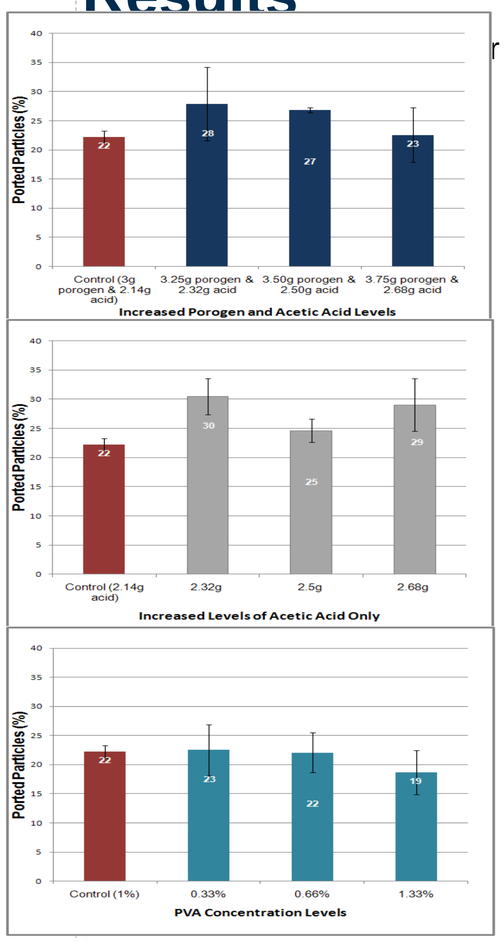

Figure 3: Average ported particle yield obtained when altering the parameters (from top to bottom) increased porogen and acid, excess acid only, and altered PVA concentration compared to control

r every group of triplicate experiments are given

The ported count was positively and significantly affected (in decreasing order) by:

1) An excess amount of acetic acid (2.32g)

2) A stoichiometric increase in both

3) An increase in stirring speed to 600 rpm

It was also proven statistically that the alteration of PVA concentration 0.66% lower addition

Conclusion

1) Addition of excess acetic acid caused the ggest increase in ported particle yield

2) Alteration of the standard PVA concentration provides no benefit in increasing ported yield

Future Work

Repeat experiments to test validity of the results for

1) addition of 2.32g excess acetic acid and
2) increase in porogen and acetic acid for levels 1 and 2

It is also planned to test combinations of these parameters with increased