

Suruthi Gnanenthiran¹, Christopher Hewitt², Pari Rao², Kate Pitt¹, James Litster¹ & Rachel Smith¹

¹. Particle Technology Group, Department of Chemical and Biological Engineering, University of Sheffield, UK ². Chemical Development, Pharmaceutical Technology & Development, Operations, AstraZeneca, Macclesfield, UK

BACKGROUND

The manufacturing of active pharmaceutical ingredients (API) is a lengthy process with many downstream processing steps after crystallisation. Drying is an essential part of virtually all pharmaceutical manufacturing processes but is often a bottleneck in the overall manufacturing process.

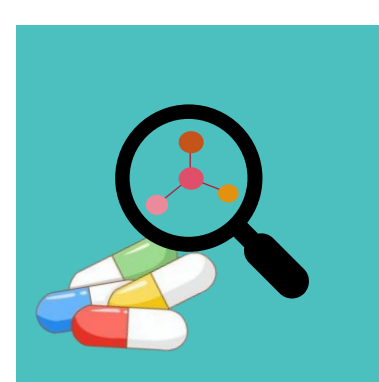
Agitated filter dryers (AFDs) are becoming increasingly prevalent in the pharmaceutical industry due to their combined filtration and drying capabilities that minimise product loss and worker exposure. The agitation enhances mass and heat transfer during drying, facilitating homogeneous mixing and shorter drying times.¹



Figure 1 – Pharmaceutical Manufacturing Process²

CURRENT CHALLENGES

The use of highly agitated conditions can result in undesired agglomeration which has several potential consequences.



Out of spec API

Size control

Long cycle time

Increased cost

Equipment damage

Hard to predict

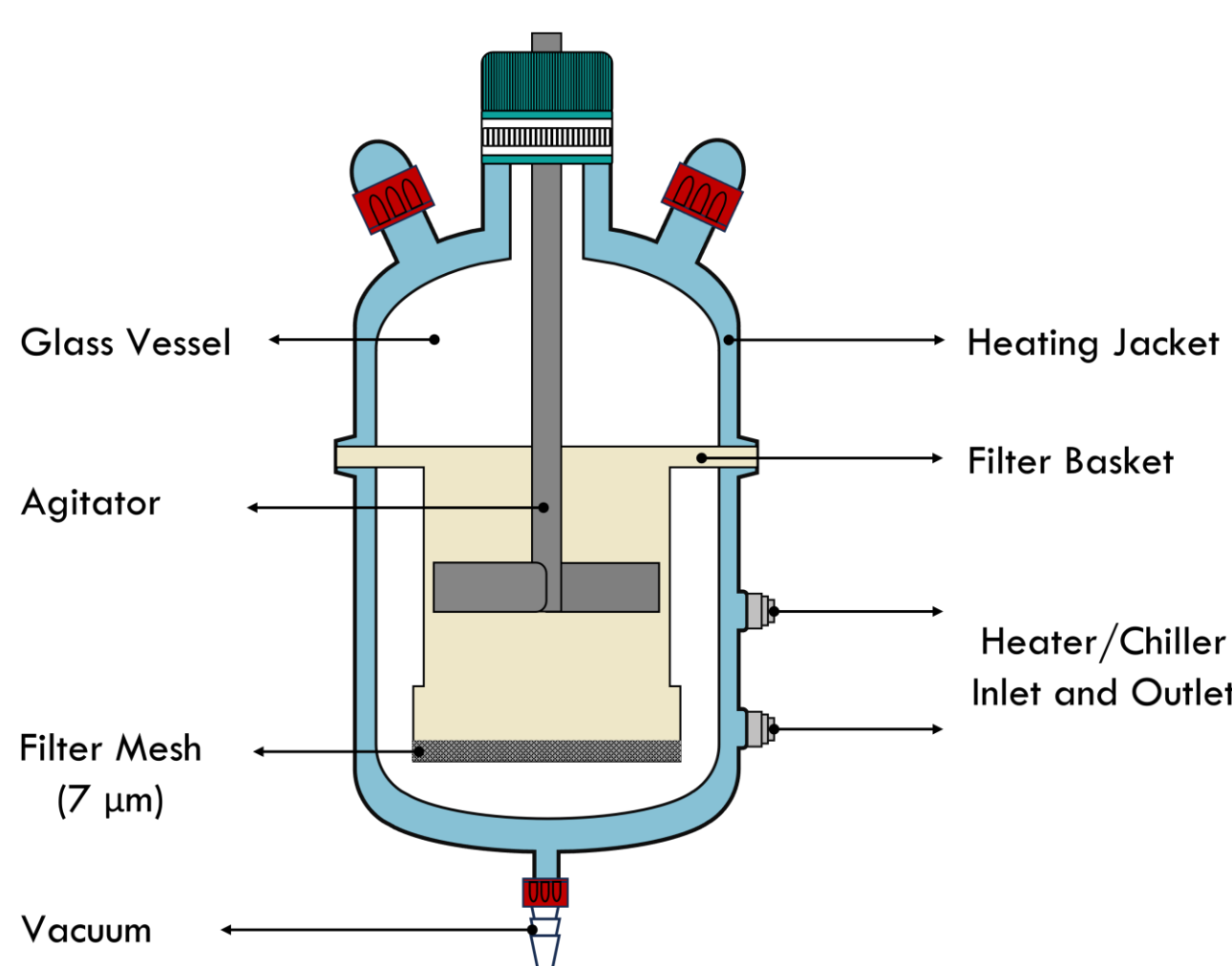
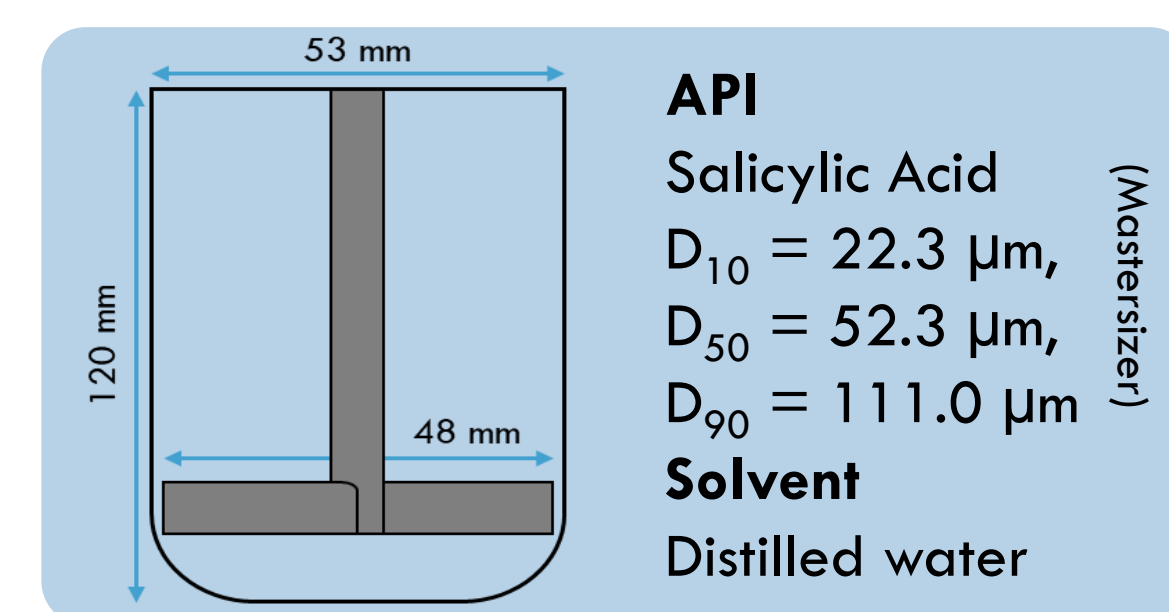


Figure 2 - Cross-sectional diagram of AFD

TAKING A MECHANISTIC APPROACH

Drying in AFDs is a dynamic process where heating and agitation of the wet cake can result in the formation of solid bridges, leading to agglomerate formation.¹ The aim of this work is to isolate the agitation component during drying to understand the relationship between the agitation input and agglomeration. The extent of agglomeration in samples with an initial moisture content of 20% is investigated. They were agitated at speeds ranging from 50 to 100 rpm for durations spanning 2 to 10 minutes.



Characterisation	Method
Moisture Content	Loss on Drying
Extent of Agglomeration	Sieving

RESULTS

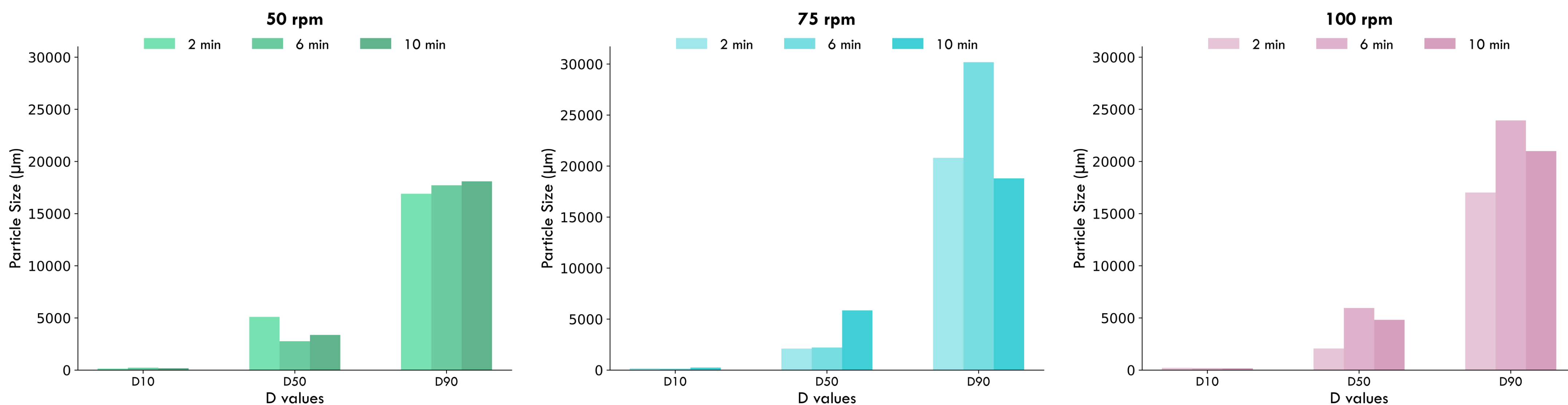


Figure 3 – D values of samples (from sieving) at various agitation speeds and times

Agglomeration observed across all variables. At 50 rpm: gradual increase in D_{90} over time. 75 rpm: increase in D_{50} over time whereas D_{90} increase at 6 min then decrease at 10 min. 100 rpm: D_{50} and D_{90} increase at 6 min then decrease at 10 min. Least overall agglomeration seen at 50 rpm. Results illustrate complex relationship between agitation and agglomeration.

CONCLUSION

Increased agglomeration seen at higher agitation speeds – highlights importance of considering material properties. Effect of agitation time on extent of agglomeration depends on agitation speed – further investigation needed.

