

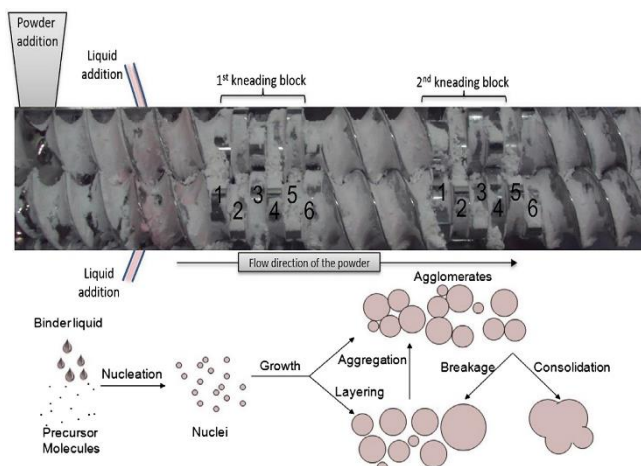
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### Goals:

- ❖ Developing a Residence Time Distribution (RTD) Model for a continuous Twin Screw Granulator using experimental data and estimating key parameters
- ❖ Developing Population Balance Models of Reactive Detergent Granulation Process and validating simulation results through small scale experiments

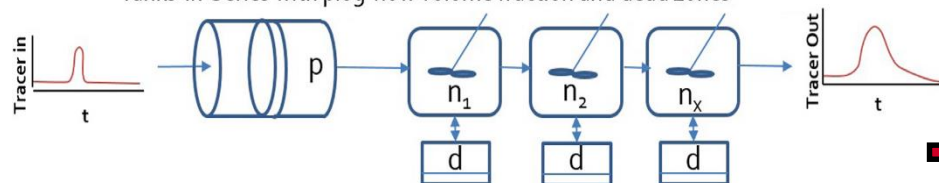
### Geometry and flow of material inside the TSG



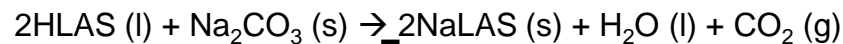
Kumar et. al. 2015

### Tank in series modelling of the TSG

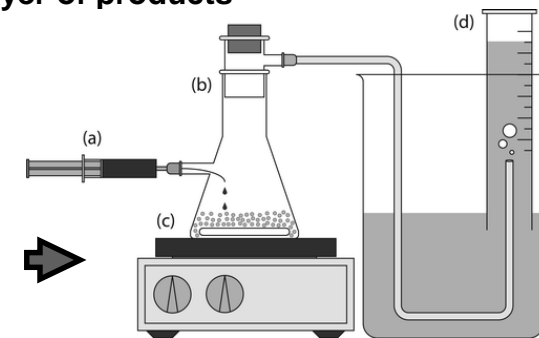
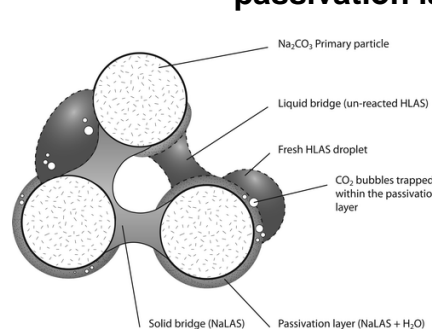
Tanks-In-Series with plug-flow volume fraction and dead zones



### Dry neutralization reaction of dodecyl-benzene sulfonate (HLAS) acid with sodium carbonate (Na<sub>2</sub>CO<sub>3</sub>)



Agglomeration of Na<sub>2</sub>CO<sub>3</sub> due to formation of bridges & passivation layer of products



Process setup for study of the reactive granulation process: HLAS added dropwise into a flask containing Na<sub>2</sub>CO<sub>3</sub> which is agitated and heated on a hot plate cum magnetic stirrer

### Parameters to be estimated:

- $\bar{t}$  : mean residence time
- $p$  : fraction of volume of TSG assumed to correspond to the plug flow volume fraction
- $n$  : number of constantly stirred tank reactors
- $d$  : dead zone of continuously stirred tank reactors