

Extrusion Granulation

An alternative Biocide Delivery system ?

- Presented By
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- Exwold Technology Limited
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Main themes of the presentation

- Introduction Exwold/ J.Robson
- Defining a granule
- Process Overviews
- The Technical Variables
- Conclusions
- Questions & Answers

Career History

- Engineering graduate Leeds University 1979 - 1982
- MBA (part time) at Durham University Business School (1991 - 1993)
- Ellis & Everard (Univar) 1983 - 1992
- Started Exwold Technology Ltd 1992 -

Introduction

- Exwold Technology Ltd - formed 1992
- Small company - world wide client base
- Produce granulated chemical formulations
- 70 staff, 24 hour shift pattern
- Sites - Billingham and Hartlepool
- Turnover approaching \$8 million
- IPPC and COMAH authorisations



Haverton Hill, Billingham

Alternative Technologies

■ Spray Drying/Fluid Bed Agglomeration

■ Advantages of :

- Rapid Dispersion
- Low Unit Cost for High Tonnages
- Uniform Spherical Sizes

■ Disadvantages of :

- Dusty and Friable
- Low Bulk Density
- High Capital Cost of Plant

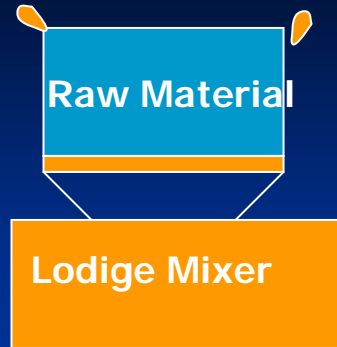
Defining a granule

- Water Soluble Granules
 - A granular agglomeration ranging from 1.5mm-5.0mm in diameter
 - Primary particle size 5-50 μ m
 - Dissolving at a controlled rate in water



Examples of Typical Extruded Granules

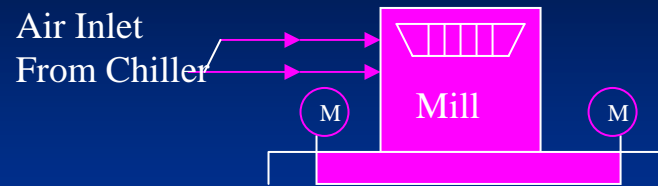
Process A



■ Chemical Neutralisation

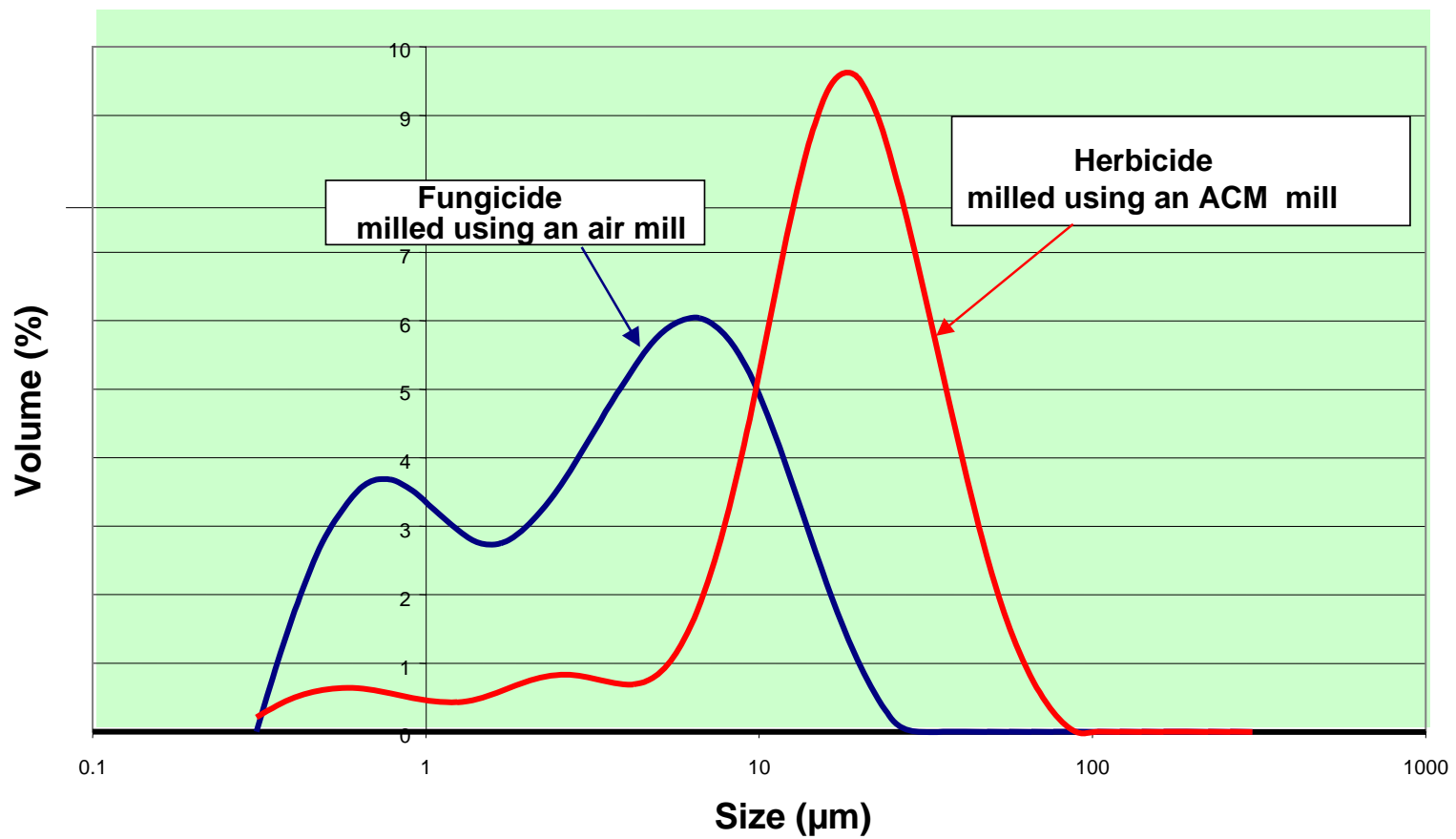
- Surface Area of Material
- Rate of Reaction
- Strength of Exotherm
- Rate of Water Removal
- Vacuum Drying

Process B

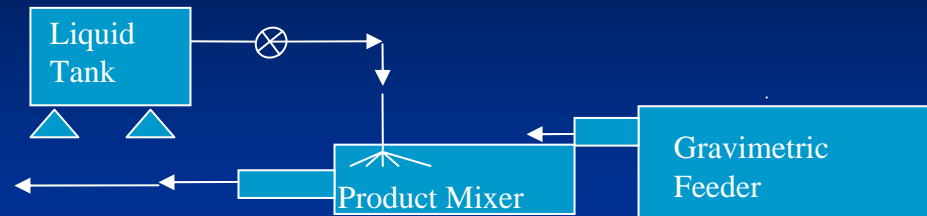


■ Milling / Micronisation

- Feed Rate
- Crystal Structure
- Air Flow
- Temperature
- Stickiness
- Humidity



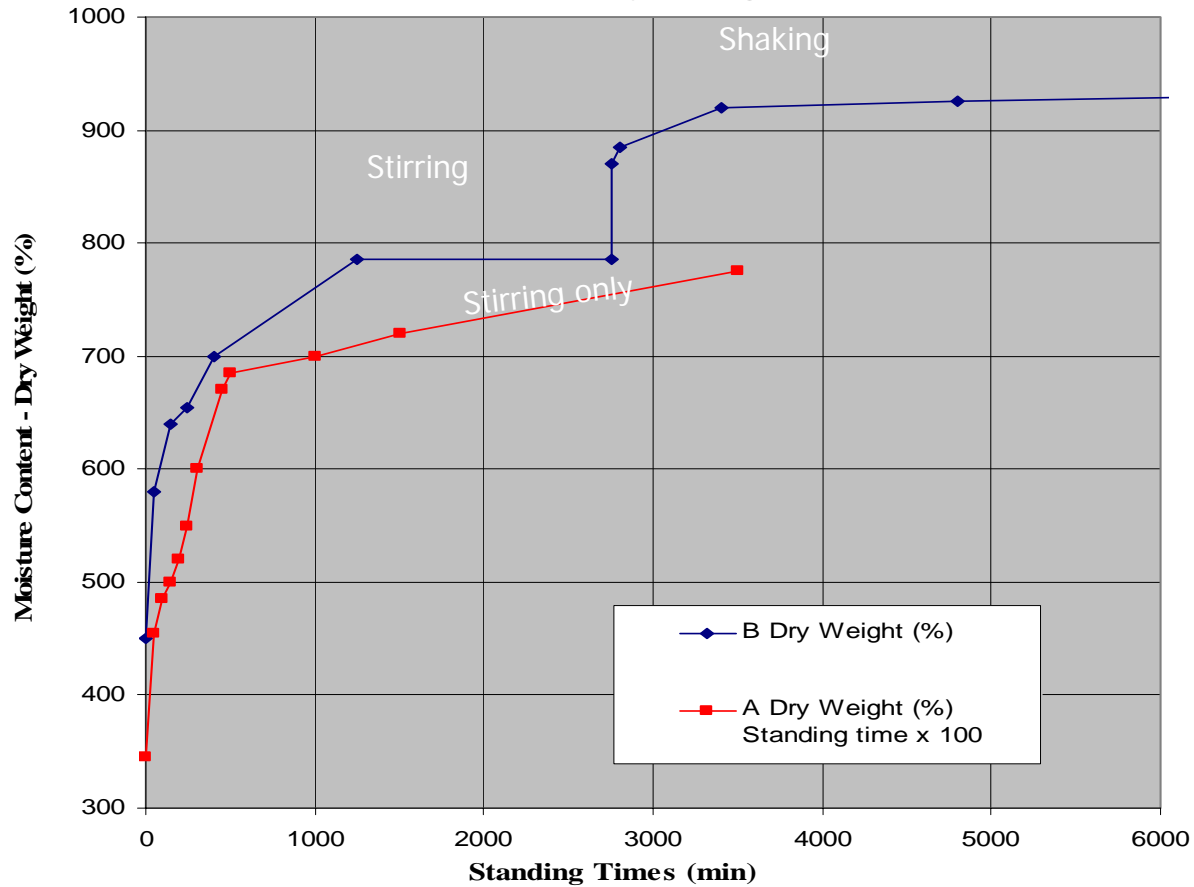
Process B



◆ Conditioning (Liquid/Solid Mixing)

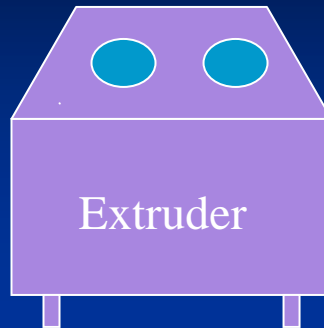
- Natural Inert Fillers & Water
- China Clay / Kaolin / Bentonite
- Residence Time
- Mixing Energy

Increase of thixotropy with time
Bentonite, Wyoming



P.G.H. BOSWELL
1961

Extrusion Stage

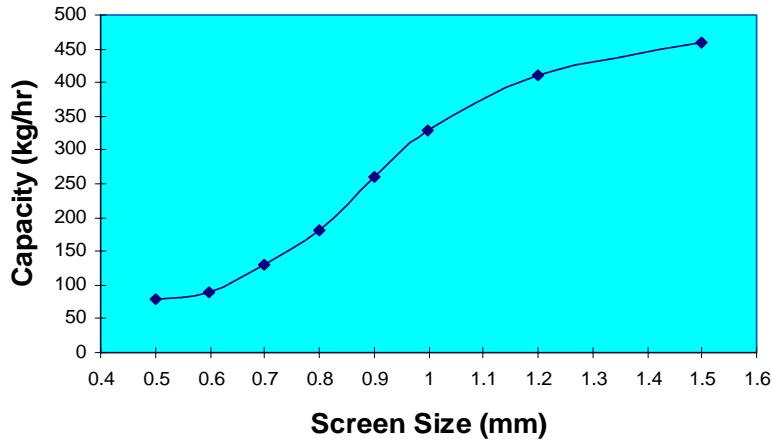


■ Extrusion

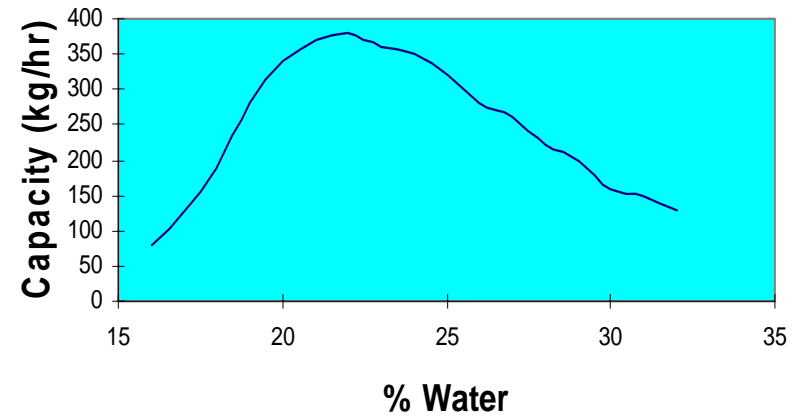
- Extrusion Diameter
- Moisture Content
- Friction/Compression
- Design of Extruder
(radial or axial)

Extruded Product Characterisation

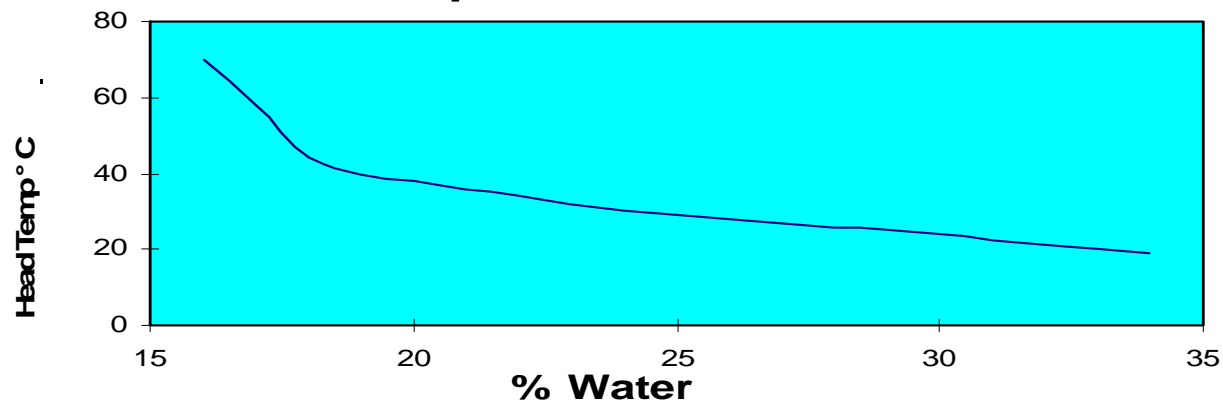
Screen Size/Capacity



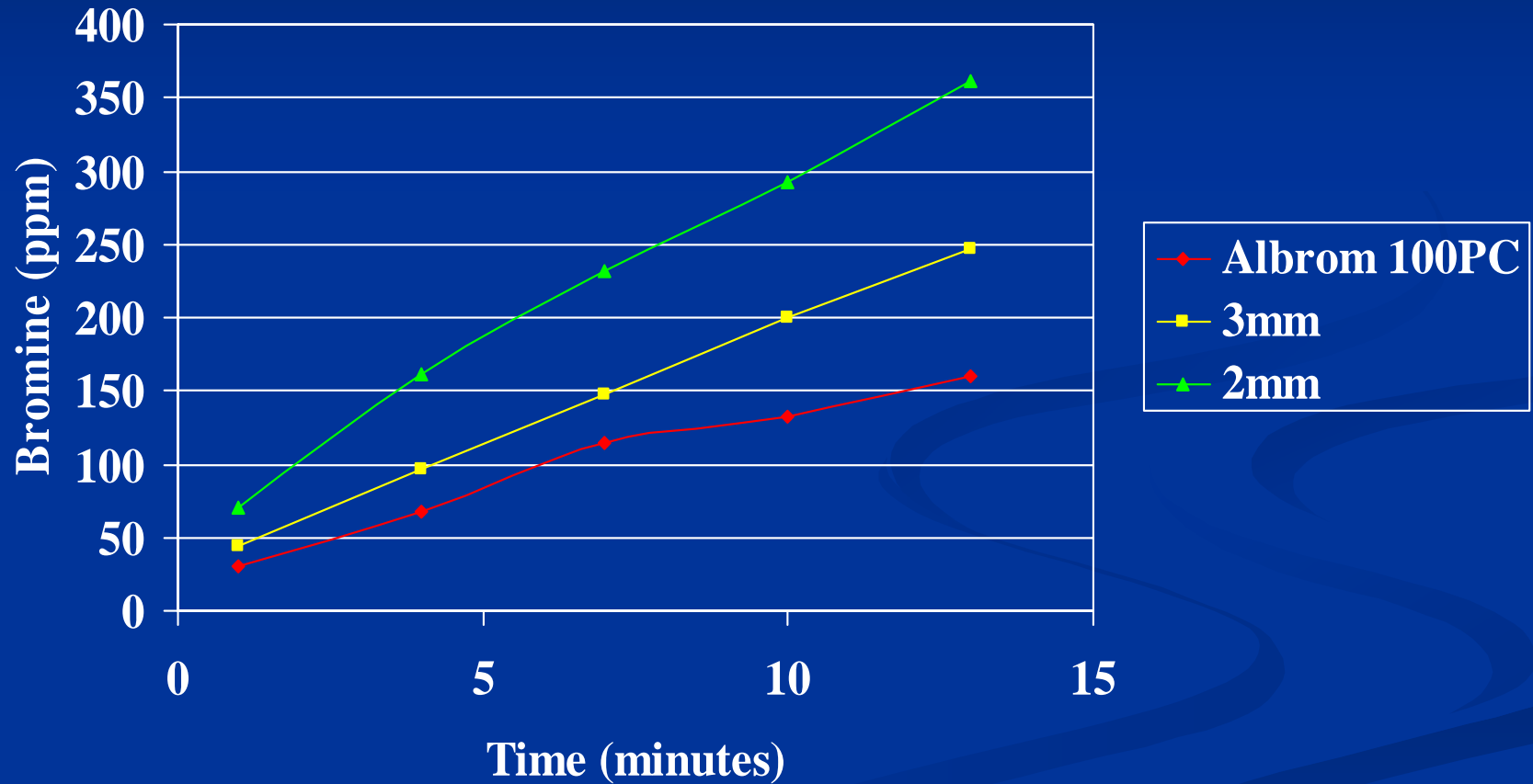
Moisture of Paste/Capacity



Head Temperature/Moisture of Paste



Dissolution Comparison



Fluid Bed Drying



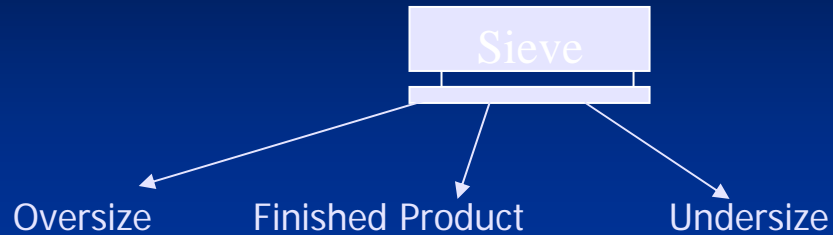
◆ Fluid Bed Drying

- Air Velocity
- Air Volume
- Air Temperature
- Residence Time



Tofts Farm, Hartlepool

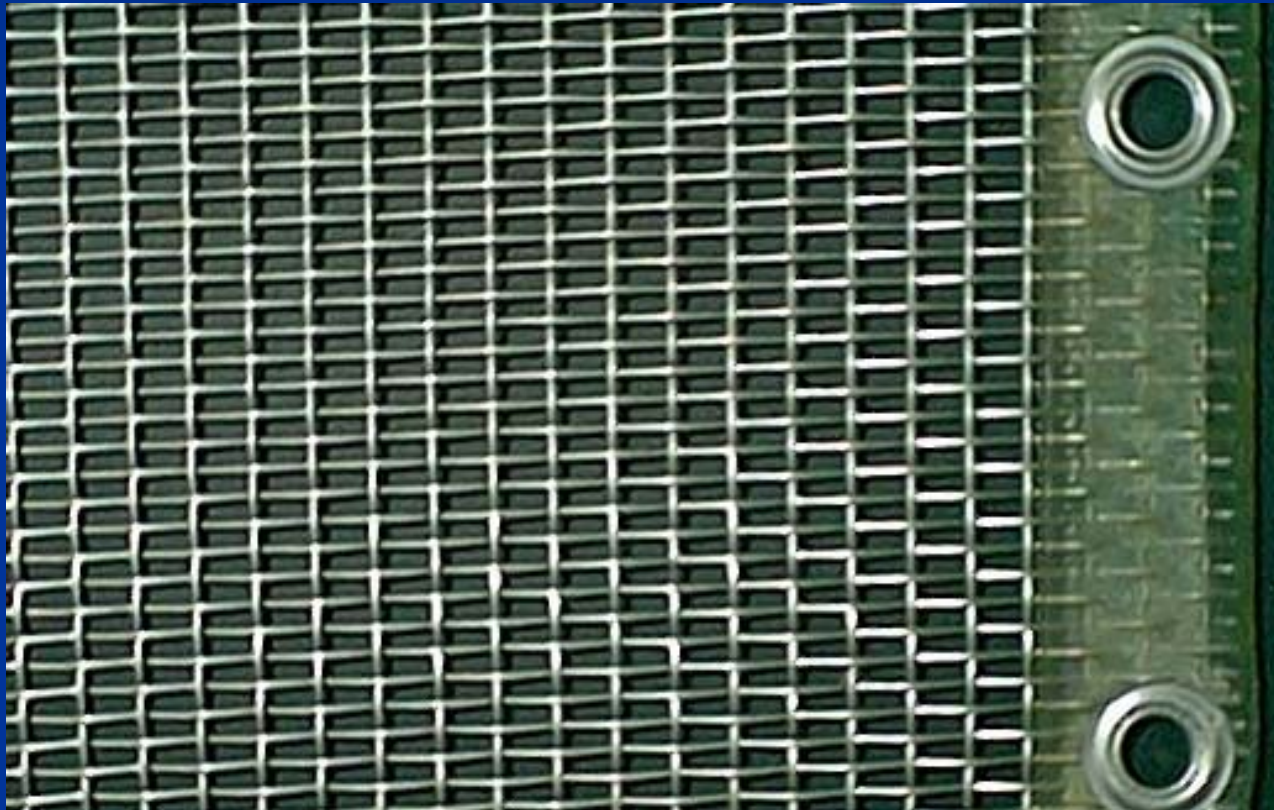
Screening

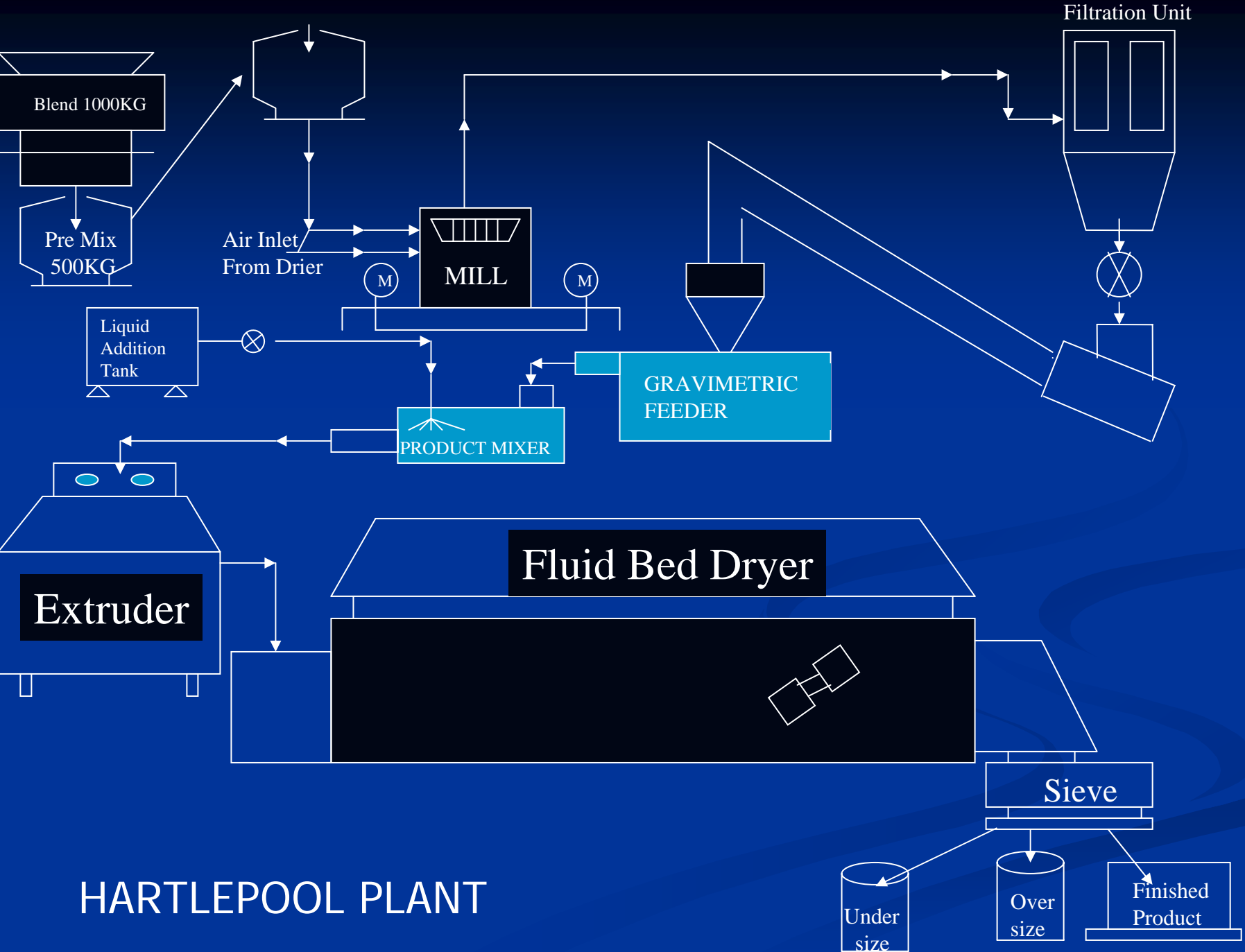


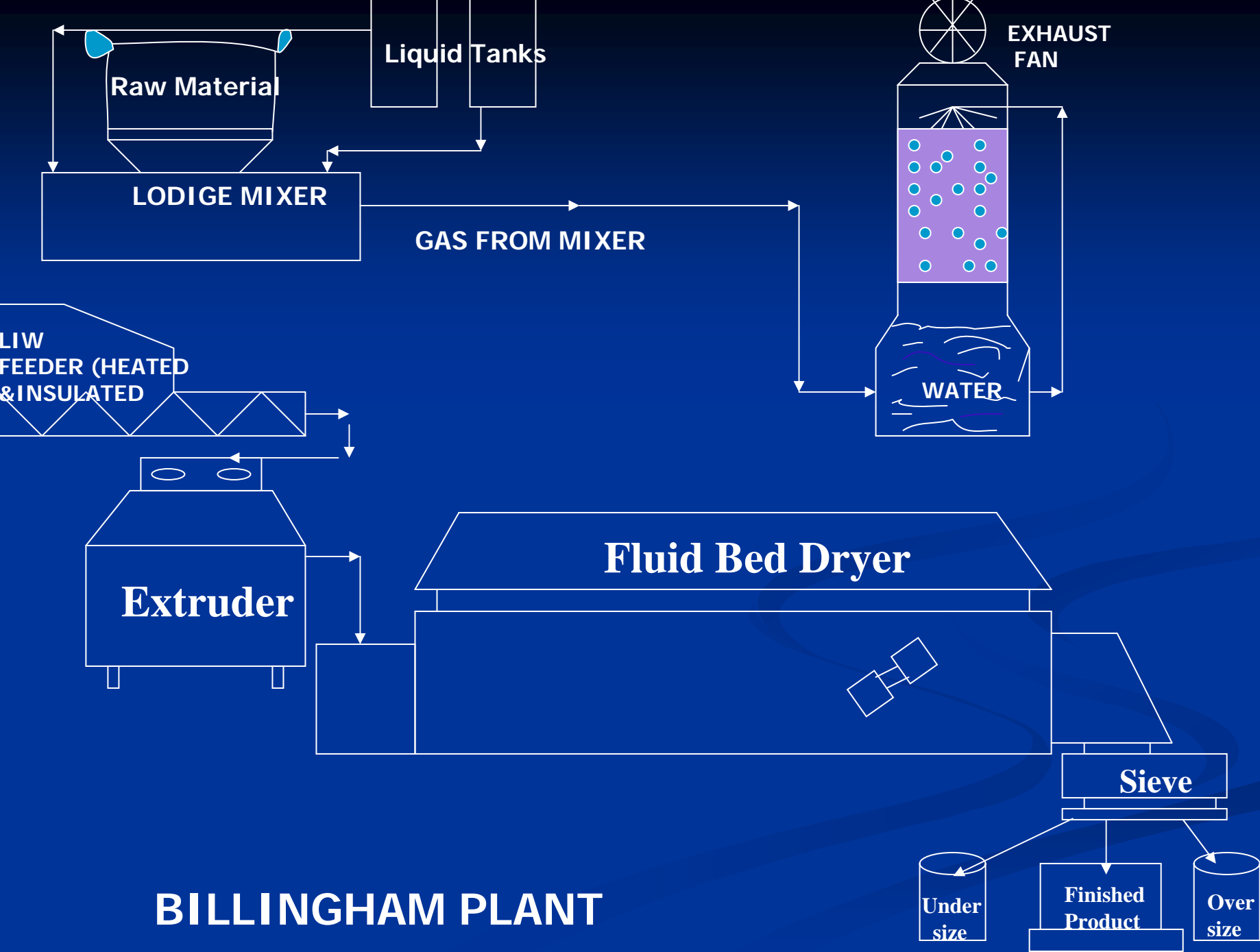
◆ Granule Screening (Sieving)

- Design of Sieve
- Screen Size
- Screen Area

An example of specialised Sieve Mesh







Conclusions

" Current low pressure extrusion granulation when used in advanced chemical formulations clearly has many interactive facets which both engineers and chemists need to understand."

"I believe that more *discoveries* will be made in the next 10 years to the point where the application of low pressure extrusion will deliver complex chemical solutions at value for money costs."