The granulation process helps powder to slide more easily, so it is compatible with operating processes and use of the finished product according to the customer's requirements. Granulation can be performed dry or wet, both in the ceramic sector and other sectors, such as fertilisers and soil improvers.

The operation of granulation is difficult because only a fraction of the granules leaving the granulation drum are in the specified product size range and problems of surging and drifting coupled with the large dead time make it difficult to control the granulation plant at steady state.

Fundamentally, fertilizer and soil improvers granulation are similar to agglomeration in other systems such as pelletization, flocculation, crystallization and aerosols. Of these, the closest is pelletization. However, because fertilizers and soil improvers are soluble (or partially), chemical composition of the particles significantly affects the agglomeration process. Moreover, other parameters such as moisture and binder dramatically affect the formation of granules (shape and dimension) (Adetayo et al) There are various possible mechanisms of granule formation (Sastry and Fuerstenau, 1973). Nucleation occurs when non-particulate matter forms new particles. Layering is the addition of non-particulate matter to the surface of particles. It is synonymous to "growth" in crystallization. Coalescence (aggregation, agglomeration) occurs when two particles successfully collide to form a single granule. The coalescence mechanism can be further subdivided into random coalescence (coalescence rate is size-independent) and preferential coalescence (coalescence rate is size-dependent).

Among all the PhD projects, I was particularly fascinated by the one proposed by Prof. Gianluca Malavasi: "Effect of raw materials, moisture and binder on the granulation process of fertilizer and soil improvers"

PhD program can be divided accordingly to the following two tasks:

1) Effect of raw materials on granulation process;

2) Effect of binder on the granulation process;

In particular for the Task 1) the research activity will be focused on:

i) Mineralogical and chemical analysis (XRD and XRF); ii) Diagenesis of raw materials (contribution of geologists); iii) Evolution of pH in the raw materials-H2O mixture; iv) Determination of zeta-potential of raw materials; v) Evaluation of raw material particles size distribution; vi) Evaluation of raw materials particles size distribution in the granules; vii) Evaluation of the binders on the partial dissolution of raw materials.

For the Task 2) the activity will be focused on:

i) Study of surface interaction between raw martials and binders; ii) Evolution of pH for the raw materials/binders/H2O mixture; iii) Study by SEM the morphology of fertilizer and soil improvers

granules (using a pilot implant of granulation available in LB Officine Meccaniche spa); iv) Density (apparent) of granules; v) Evaluation of the binder effect on the dissolution of raw materials and granules

Above mentioned data will be used to find qualitative and quantitative correlation between structure and properties in the granulation process and to help technical department to develop the right equipment and process for each products.