25 Scheduling of Synthetic Granulate

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This case study deals with a project which has been finished in its first version in the process industry in 2000 with a quite early release of APO PP/DS and which has been further improved by new releases of SAP APO with their additional functions and the integration of more parts of the supply chain. It was the first APO PP/DS project that managed to keep up with the difficult scheduling requirements in the field of the chemical and process industries.

This case study is structured in the following sections: First, the general production process of the synthetic granulate in the featured plant is presented. This chapter focuses on the special planning problems which occurred in this example. Subsequently, the modelling of the production process in APO PP/DS is described in detail, and some more information about modelling production processes in APO PP/DS are provided in addition to the general information given in Chap. 10 as well as a short view to the planning process. At the end of this case study the results of this APO implementation are estimated briefly as they could be measured today and the lessons learned are presented.

25.1 Case Description

The production process dealt with in this case study is the production of synthetic granulate. In technical terms it is a four step hybrid-flow-shop production process. The granulate is widely used in many different industries, especially in the automobile and pharmaceutical industries. About 3000 different products make up the full product spectrum which grows and changes rapidly.

The basic principle of the process (see Fig. 25.1) is melting the undyed granulate in extruders, adding color substances and perhaps other additives and extruding the colored granulate again. Depending on the product type, a mixer is used afterwards to create homogenous batches. If the granulate is shipped in bags, an automatic bag filling machine may be used. Otherwise the filling of the granulate in different types of containers is done directly at the extruders or mixer. Depending on the production sequence, transport containers may be needed during a part of the production process. At the end of the production process some more days are needed for the necessary quality checks.

The selection of resources for the production process depends on the product type. For the extrusion process several individual extruders can be used.
These resources differ with respect to speed, types of color that can be added and types of undyed granulate that can be processed. The actual usage of the individual extruder depends on the product type and the lot-size of the production order. Generally speaking, for each product there are several extruders with different priorities that can be used for the extrusion process. As there is a high variety of products with very different chemical and physical characteristics, the scheduling of orders on the extruders is very critical. Depending on the sequence of the production orders, setup times for cleaning the extruders vary between nearly no setup time and up to five hours.

Products with special quality requirements by the customer have to be mixed afterwards to create batches with homogeneous characteristics. For this part of the production process several mixers with different capacities are available. The selection of the mixer is lot-size dependent. Also the setup times on the mixers depend on the sequence of production orders, but the scheduling is less critical, as the setup times are shorter and the mixer is usually not a bottleneck. Granulates which are shipped in bags can be packed in two different ways. The first alternative is packing directly at the extruder or mixer which requires no additional resources. This procedure is chosen for production orders with small lot-sizes. Large production orders are packed with a special automatic filling machine which has to be planned separately. The setup times are sequence dependent as well, but less problematic than setup times on extruders. A further resource group, the transport containers, is needed, if a product needs the mixer or the filling machine or both of them. As the automatic filling in bags does not take place directly at the extruder, the transport containers are used to transport the loose granulate from extruder to mixer and further on to the filling machine. Since the number of available transport containers is limited, they must be considered as a relevant resource. The last resource group is the personnel required to operate