Scheduling of Food Process Industries

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The performance of food processing plants depends on operators and managers making correct and timely decisions. These are mainly derived It has been long realized that without computer-aided scheduling tools production staff cannot see the full consequences of their actions. The direct effects resulting from these decisions include tying up essential equipment, delaying completion of orders and adding to overtime costs. As a result, productivity is reduced, customers are disappointed and profits suffer. Although production scheduling is a widely studied topic in the context of process industries, it has received little attention in real food processing industries [1].

This work presents the deployment of a Mixed Integer Linear Programming (MILP) model for the optimal scheduling of a real-life food industry. In particular, the case of yogurt production, a representative food process, in a large-scale dairy facility from Greece is studied in detail. The plant under consideration produces over 250 different yoghurt products including set, stirred or flavored yogurt. The overall production schedule is affected by complex production recipes, mixed batch and continuous operations, several common resources, tight operating constraints, different ways of plant operation, economic and technical data [2]. In this work timing and capacity constraints along with switchover times are imposed with respect to the batch stage (fermentation) to ensure the generation of feasible production plans and optimal production scheduling in the packing stages.

A MILP-based approach developed in our previous work provides the basis for developing a tight formulation to solve this complex industrial scheduling and re-scheduling problem [3]. Time representation relies on a hybrid discrete and continuous approach. The idea of product families provides an efficient way to reduce computational cost without loss of feasibility or optimality. Plant-specific operational constraints are imposed by adding tight integer cuts in the model to reduce computational costs. The specific targets which are set by the needs of the industry are to: (i) reduce the total production costs by better management of the various resources, (ii) reduce the time for the production of new products and (iii) testing of new production recipes and improvement of product quality. A number of case studies are used to illustrate the

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applicability of the MILP approach including optimal re-scheduling decisions to address uncertainty issues such as changes, modifications or cancelations of product demand orders.

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