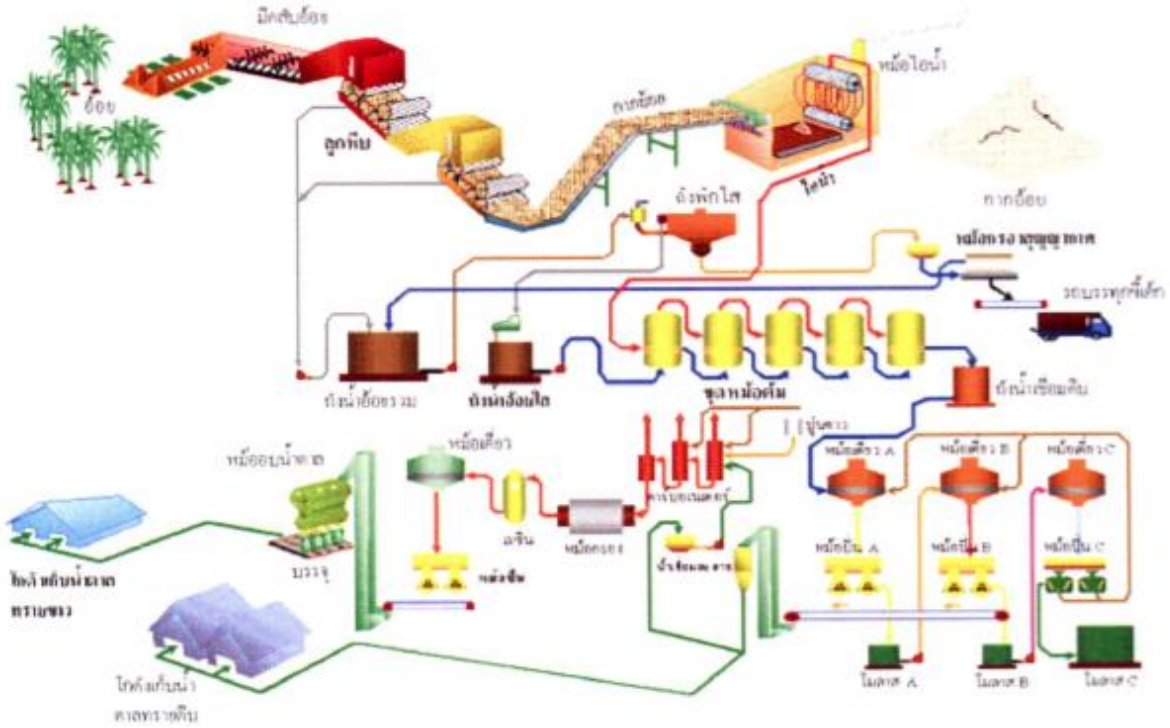
Workshop "Design a Smart Manufacturing for Sugar Production Processes"

1. Students work as a group of 2-3 and design a smart manufacturing for sugar production processes using industry 4.0 technologies and smart manufacturing concept.

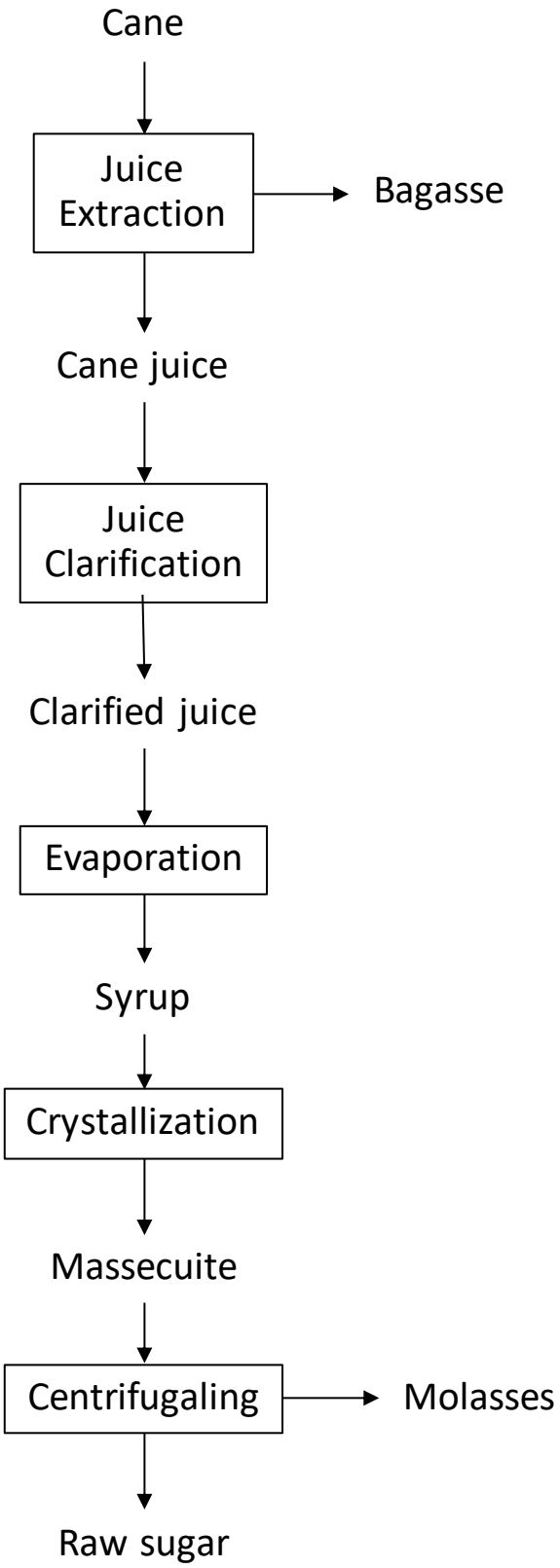
2. The details of the sugar production processes are provided.
3. Duration of the workshop is 1 hours.

4. Each group will propose and present the designed smart manufacturing model for the sugar production processes at the end of workshop.

Sugar production processes



Process flow of raw sugar



Raw sugar production processes

In raw sugar production, the processes can be divided into 5 steps as follows.

1. Juice extraction

Cane is transported using a conveyor to a shredder (breaking cane into small pieces) and then the shredded cane is transported to a set of mills for juice extraction. The shredded canes exiting the last mill is called bagasse.

2. Juice Clarification

The juice from the mill is transported to a clarifier to remove heavy particulates using heat and lime. The clarified juice is a product of this process.

3. Evaporation

The clarified juice is passed through heat exchangers to preheat and to multi evaporator. The syrup with 65% solids and 35% water is produced.

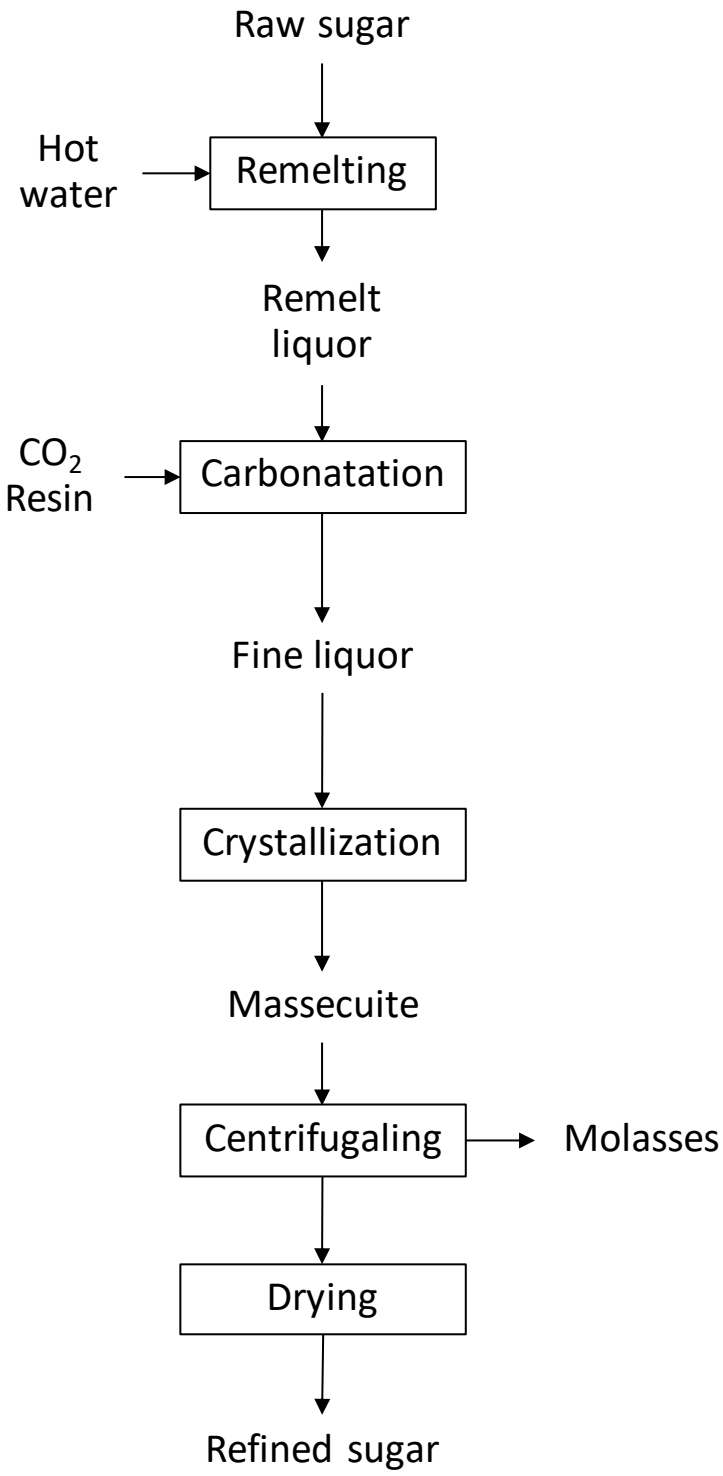
4.Crystallization

The syrup then goes to a vacuum pan for crystallization. In this process, the mixture consists of liquor and crystal known as massecuite.

5. Centrifugaling

The massecuite is centrifuged to separate the molasses from raw sugar. The raw sugar is stored in a silo for refined sugar production.

Process flow of refined sugar



Refined sugar production processes

In refined sugar production, the processes can be divided into 5 steps as follows.

1. Remelting

Raw sugar is remelted and remelt liquor is produced.

2. Carbonatation

The remelt liquor is screened to remove any particulate. Cabonatation consists of adding lime to raw melter liquid and then bubbling carbon dioxide through the liquor to produce a calcium carbonate precipitate. The decolorization remove soluble impurities by adsorption. The fine liquor is produced in this process.

3. Crystallization

The fine liquor is sent to a vacuum pan and then massecuite forms.

4. Centrifugaling

The massecuite is centrifuged to separate the refined (white) sugar from molasses.

5. Drying

The refined sugar is sent to dryer and packed for sale.