Development of the new beet extraction technology by Fives Cail – the TowerMax and EcoMixer

Mark Taylor, Jean Luc Magalhaes, Jean Urbaniack, Frederic Payen

Fives Cail developed a tower extraction system with own technology. The extraction plant comprises both the TowerMax tower extractor and the EcoMixer countercurrent cossette mixer for the solid/liquid extraction of the sucrose from the cossettes as well as peripheral equipment (heaters, foam separator, pulp strainers and sand removers). The extraction plant is operated and controlled from panels on which all instruments are connected. The extraction equipment has been designed for minimal maintenance. This paper describes the sustainable industrial development of this new technology by adhering to the principles of the Fives Cail Group of reliability, performance, automation, energy savings and client satisfaction.

Key words: extraction, countercurrent mixer, tower extractor, Fives Cail

1 Introduction

Throughout the history of the Fives Cail Group from the conception of the company through to today the company has been involved in the design and supply of equipment for the extraction of sugar from either sugarbeet or sugarcane. At the beginning of the development of continuous extraction of sugar from beet the Fives Cail Group started to build RT type extractors. Rapidly the Fives Cail Group became the world leader in the design and development of this technology with over 240 references worldwide. Later the first tower extractor was developed (Hempelmann, 1999) and Fives Cail manufactured and installed several countercurrent cossette mixers and tower extractors in the late 1970’s and early 1980’s. Fives Cail continue to support RT extractors and have carried out many projects to maintain and improve the performance of RTs’ including increasing their throughput by over 2.0 times their original nominal design capacity.

In 2005 and 2006 the Fives Cail Group along with its partners Maguin S.A.S of France and O.E.P of Turkey built a new 10,000 t beet/d green field sugar factory at Bogazliyan in Turkey. This factory is composed with all the latest equipment, designed to the highest standards in terms of reliability, performance, automation and energy consumption (Le Maout and Dedole, 2007).

For that reference, one area of key equipment in the beet sugar process that was missing from the range of equipment which the Fives Cail Group could provide its customers with was the tower extraction system. The Fives Cail Group would like to propose to its customers a global approach to the design of the beet sugar process and to be able to offer them the full range of equipment which will meet all customers requirements, so the decision was taken to develop the tower extraction system with Group’s own technology allowing the Group to offer the full range of equipment. The tower extraction system designed provides this in terms of extraction performance, overall energy consumption, space requirement and capital costs as for all Fives Cail Group equipment. This paper describes the sustainable industrial development of this new technology by adhering to the principles of the Fives Cail Group of reliability, performance, automation, energy savings and client satisfaction. Fives Cail has used it’s considerable knowledge in the extraction process, in mechanical design know how, experience in local manufacture and past experience with tower extractors to complete the development of this equipment.

2 General description

The extraction plant comprises the TowerMax tower extractor, the EcoMixer countercurrent cossette mixer and peripheral equipment (heaters, foam separator, pulp strainers and sand removers), see Figure 1. Fives Cail offers a range of plants starting from 4,000 t beet/d to 14,000 t beet/d which cover all market demands (see Table 1). The TowerMax is a countercurrent tower extractor which comprises a base with shaft support and bearings, vertical and horizontal screens, cossettes inlets and juice outlets, an extraction zone
with moving and fixed arms to transfer cossettes from the bottom
to the top of the tower and an upper part with motorization and
2 pulp extraction screws. Residence time of the cossettes in the
extraction zone is between 90 and 120 min. Screens are cleaned
permanently by scrapers. An additional cleaning by juice is done
when necessary.
TowerMax is designed with proven process rules. Construction
rules emphasize robustness associated with cost analysis through
local manufacturing possibilities. Reliability and control including
safety alarms ensure low maintenance cost and optimized opera-
tion of TowerMax. The EcoMixer is a countercurrent cossette mix-
er which comprises a body with fixed arms, a motorized rotating
shaft with moving arms and mixers, screens for juice coming from
the foam separator and raw juice. All parts in contact with products
are in 3Cr12 or stainless steel.

3 Equipment process design requirements

It was decided at the outset of the development of the tower ex-
traction system that the equipment design would not depart sig-
nificantly from existing proven technology to ensure a robust and
safe operation of the equipment and that the operating performance
should provide minimum energy consumption, low draft, maxi-
mum extraction performance and to produce a wet pulp suitable for
pressing. It was decided that the following operational data would
be the goals of the equipment design:
– Draft: 95 to 115% on beet
– Steam consumption: 1.3 to 1.9% on beet
– Sugar losses: 0.2 to 0.25% on beet
–