BURRIS, BRIAN[1*], YVAN BATHANY[2] and HANNU PAANANEN[3], [1]Novasep Inc., 23 Creek Circle, Boothwyn, PA 19061, [2]Novasep Process, Site de Saint-Maurice de Beynost, 5 chemin du Pilot, 01798 Miribel, France and [3]Danisco, Sokeritehtaantie 20, 02460 Kantvik, Finland. **Improved betaine recovery during molasses desugarization using the NS2P chromatography process.**

ABSTRACT

The objective of this presentation is to show how the NS2P (New Sequential, 2-Profile) chromatography system allows for the recovery of a new revenue stream, betaine, in the molasses desugarization process. A traditional SMB typically yields two separate product streams, sucrose and a by-product 'salt' stream. The NS2P is a three-fraction chromatography system and in addition to the new enriched betaine stream, also yields improved sugar recoveries compared to traditional two-component SMB systems. Also discussed is a brief overview of how to convert a traditional two-component molasses desugarization plant into an NS2P system and typical sugar and betaine purities and recoveries. A new NS2P would need a large initial investment but would immediately produce two revenue streams. To retrofit an existing traditional SMB would be less expensive and would yield both improved sucrose purity and recovery with the addition of the new betaine product revenue stream.

The NS2P process is a combined batch process and SMB (Simulated Moving Bed). Two separation profiles reside in sequence, one after the other, inside the system. This results in good utilization of the resin bed. It is a multi-section, single column SMB and is not what may be called a 'traditional' SMB that has continuous and steady flow rates of feed & elution water inlets and outlets of by-product salts and product sugar. The traditional SMB has a higher internal recycle flow rate compared to the inlet and effluent flows. The NS2P runs with discontinuous feed & elution flows that approximate what would be the internal recycle rate of the traditional SMB. Modest piping alterations are needed to convert the traditional SMB as larger feed and elution piping is needed to handle the increased flow rates. Also, additional water is needed because it is necessary to use more elution water to get the third product cut from the system. This also then calls for the need for additional evaporation capacity to remove the additional water associated with the new betaine cut. Additionally there would be the need for programming changes to handle the different sequence steps to produce the three product streams.

In order to design the retrofit of a traditional SMB it is necessary to complete a 'pulse test' to evaluate the distribution efficiency in the unit as well as to determine the actual cut points for the different fractions that would exit the NS2P. A pulse of feed is injected into the system and then is washed with water and recycled around the system. As the feed recycles samples are collected along the system as the separation profile develops. After the dry solids profile passes the last sample point the profile is graphed and the actual component 'cut points' can be designed into the system. During operation the following cuts are produced:

- Cut 1: Raffinate – this is the fastest moving constituent, mostly color and ash. This cut contains no sugar or betaine and can be easily measured via conductivity and % DS.
- Cut 2: Low color/ash, with some sucrose @ > 30% of the dry solids. This cut is internally recycled as pre-feed.
- Cut 3: D-fraction, at a sucrose purity of ~ 75% and ~ 20% DS. This is used for molasses dilution and increases the sucrose purity to the system.
- Cut 4: Sucrose cut, ~ 25-30% DS, 91.5-95% purity and 90.5-93% recovery.
- Cut 5: Betaine/sucrose cut, which is recycled back to the feed zone. This cut is low DS and contains approximately equal concentrations of sugar and betaine.
- Cut 6: Betaine, recovered to a separate tank at ~ 95% recovery and < 1% sucrose.

A typical two-component molasses desugarization unit may recover about 30% of the betaine in the sucrose fraction. After conversion to the NS2P system it is possible to recover 95-98% of the betaine as a separate product, virtually sugar-free. As the molasses feed composition changes during operation, changes in the sucrose and betaine cut analysis are usually not seen. These changes in the feed composition are seen and reacted to via the on-line measurements that 'optimize' the separation and yield very steady-state production of the products.

In summary, use of the NS2P chromatography system makes it possible to produce a new betaine revenue stream at a molasses desugarization plant. The typical sucrose product is produced at 91.5-95% purity and 90.5-93% recovery. The betaine product can be produced at 67-78% purity containing < 1% sucrose at 90-98% recovery.