
CHROMATOGRAPHIC SEPARATOR EXTRACT PROCESSING

OR

*WHAT THE HECK IS EXTRACT AND
WHAT AM I SUPPOSED TO DO WITH IT?*

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THE AMALGAMATED SUGAR COMPANY
TWIN FALLS, IDAHO

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Section F

Chromatographic Separator Extract Processing

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What the Heck is Extract and What Am I Supposed to Do With It?

In spite of the fact that at the time, the term extract could not even be found in the working vocabulary of most Sugar Bums, we at the Twin Falls Factory of the Amalgamated Sugar Company found ourselves having to deal with this "phantom" material. Now as any operator here can attest, we all take great pride in somehow being able to produce pure, white, granulated sugar from so called beets disguised as black, ugly masses of protoplasm and protein. So... how tough could it be to make sugar out of.....extract? We were all very confident until the word came down from research...that is from Mike, and Kathy and Tom and Dennis... and the word was " No Problem - Trust Me!" Now I don't know what that does to you, but those words reminded me of a blind date I once had when my good buddy said " No Problem - Trust Me!" With that being said, let's look at the processing of extract in comparison to thick juice - a juice stream with which all of us are intimately familiar.

On December 23, 1988, the Amalgamated Sugar Company commenced the operation of a TASC0 Molasses Chromato Separator. This was the culmination of a tremendous effort on the part of TASC0 Research, Engineering, Construction, and Operations personnel to develop, design, build and commission a molasses desugarization process. In less time than it took to say "Sugar", we were back at it again,

designing and building a second separator which was placed on line in April of 1990. With two separators on line, we went from a factory with no extract to one producing and having to deal with approximately 200 TPD.

What is Extract?

The purpose of a separator is to separate the sugar in molasses from the nonsugars, which is done utilizing an ion exchange resin.

The molasses to be treated by the separator contains sucrose, glucose, fructose, sodium and potassium salts, amino acids, raffinose and a large assortment of other organic materials. As the molasses moves through the resin, the sucrose is more easily absorbed by the resin than other components and therefore moves along at a slow rate. The sodium-potassium salts and many other components are rejected by the resin and move along at a faster rate. Therefore, the non-sucrose moves ahead and leaves the sucrose behind. By removing material from the resin at appropriate points a sucrose rich fraction and a non-sucrose rich fraction can be obtained. Extract is the sucrose rich fraction that results from the chromatographic separation of molasses into its sucrose and non-sucrose components.

" What do I do with it?"

During the 1988 and 1989 beet and juice campaigns, extract, which in its dilute form directly from the separator is approximately 35 brix, was concentrated in a two effect evaporator system to 70 brix and then entered the process on the sugar end at

the high melter. Extract sugar made up approximately 10% of total sugar entering the sugar end, so thick juice flow was balanced between the sugar end and outside thick juice storage to fully optimize sugar end capacities. The replacement of thick juice with concentrated extract on the sugar end did not noticeably alter sugar end operations during those operating periods.

Since the separator was utilized during 330 operating days per year, extract produced during the 3 1/2 - 4 months that the sugar end was not operational was concentrated to 68 - 69 brix and stored as thick extract in outside storage tanks. No filtration or pH adjustment was necessary, and other than cooling to 20°C no special handling of the extract was required for storage. The factory lab monitored stored extract purity, pH and invert every two weeks to determine storage quality. Observations indicated that extract was a pH stable material that stored very well with only a slight increase in color over time (approximately 500 ICUMSA units). The stability of stored thick juice appeared be equal to or slightly better than thick juice when compared under similar storage conditions.

Thick extract was stored throughout the summer until mid August when the extract juice was brought into the factory to be processed during an extract juice campaign. The process of producing granulated sugar from thick juice and extract was the same and utilized normal sugar end equipment and procedures.

The most significant difference observed between extract and thick juice was color. Thick juice color averaged 1800 ICUMSA

units the last two juice runs, with extract being 4800 and 7100 for the extract runs of 1988 and 1989 respectively. Molasses feed syrup to the separator, from which the extract was generated, ranged in color from 32,200 to 46,800 ICUMSA units which indicated there was an 85% to 90% color elimination across the separator. The higher extract color profile extended through the sugar end to the final molasses and resulted in higher centrifugal wash water requirements, slightly higher standard liquor purities, lower daily white sugar production, higher white sugar color, and increased energy requirements on a therms per CWT basis. On the plus side, extract sugar produced was extremely low ash, .003 vs. .009 for thick juice sugar, and molasses purities approached those possible with a quentin ion exchange system because of the separator elimination of sodium and potassium salts and other melassigenic materials. Molasses produced during the extract juice campaign was discarded as a purge mechanism to rid the system of nonseparable nonsugars. Sugar boilers noted a slight reduction in pan boiling time when using extract standard liquor, and a reduction in fondant was required to maintain MA specifications.

Comparative information for the 1988 and 1989 thick juice and extract campaigns is listed in Table 1. This details the most significant variations observed between the processing of thick juice and extract.

There was some skepticism as to the processability of extract due to the words from research " No Problem - Trust Me!"

But what we found was that extract from the

TASCO Chromatographic Separator:

1. Processed very comparably to thick juice.
2. Required no additional pre-treatment which maintained the environmental advantage of the separator through the final processing of its sugar rich extract stream.
3. Required no sugar end equipment modifications.
4. Allowed the separator to be utilized on a year round operational basis

So....what is extract and what am I supposed to do with it?

Extract is the sucrose rich fraction that results from the separation of molasses into its sucrose and non-sucrose components which in its concentrated form can be handled just like thick juice in the way it is stored, handled and processed.

TABLE 1

	EXTRACT RUN		JUICE RUN	
	1988	1989	1988	1989
Purity - Extract/Thick Juice	92.6	92.5	91.8	92.1
Purity - Standard Liquor	94.6	94.9	93.8	94.1
Brix - Extract/Thick Juice	68.9	68.4	68.6	68.4
pH - Extract/Thick Juice	9.1	9.6	8.8	9.4
Color - Extract/Thick Juice ICUMSA units	4800	7100	1800	1700
Color - Standard Liquor ICUMSA units	4700	6100	2300	2500
Color - White Sugar - RBU	32	35	20	18
% Ash - White Sugar Extract/Thick Juice	.003	.003	.009	.010
*1 Net Production - CWT/day Extract/Thick Juice	13230	13417	16693	14922
*2 Purity - Molasses - AP/TP Extract/Thick Juice	68.55 52.10	59.11 52.72	63.78 59.10	62.49 55.30
Therms - CWT Sugar Extract/Thick Juice	5.18 *3	3.83	2.85	2.54
Wash Water - White Centrifugals Extract/Thick Juice - Seconds	18	24	-	15
Color - Molasses Feed to Separator - ICUMSA units	35100	47700	-	-
Color - Extract From Separator ICUMSA units	4800	7100	-	-

*1 Maximum production capability on a daily basis appears to be approximately 16,500 CWT for extract - 18,000 CWT/day for thick juice.

*2 Apparent purities based on pol are not meaningful due to concentrations of invert, raffinose, amino acids, and others that interfere with accurate indications of sucrose.

*3 Reflects short length of campaign, additional wash and lower production rate.

Chromatographic Separator Extract Processing

Or

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supposed to do with it?

**Extract ?
No Problem - Trust Me!**



Tom



Mike

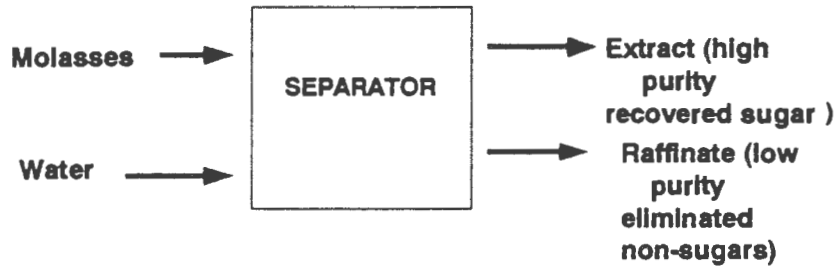


Dennis

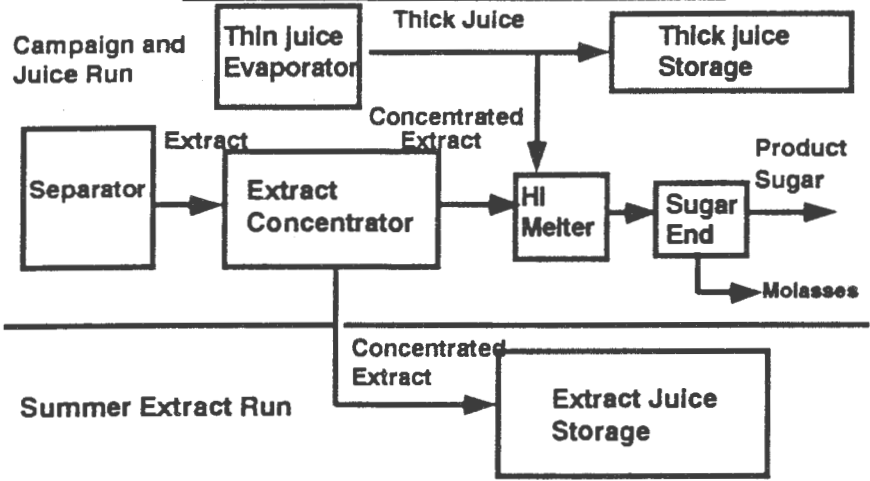


Kathy

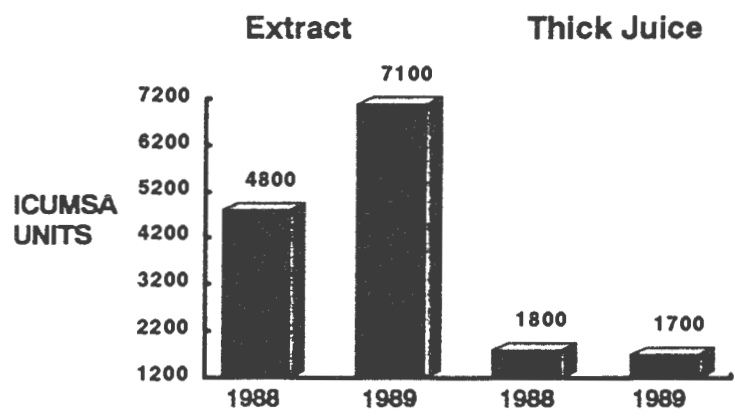
General Description of Separator Process



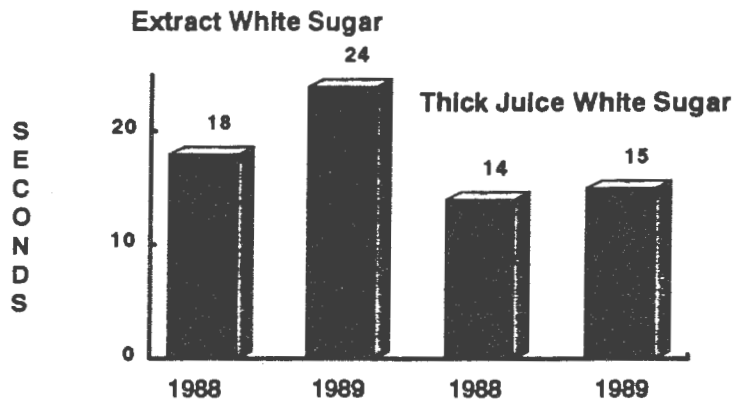
Factory Process Schematic



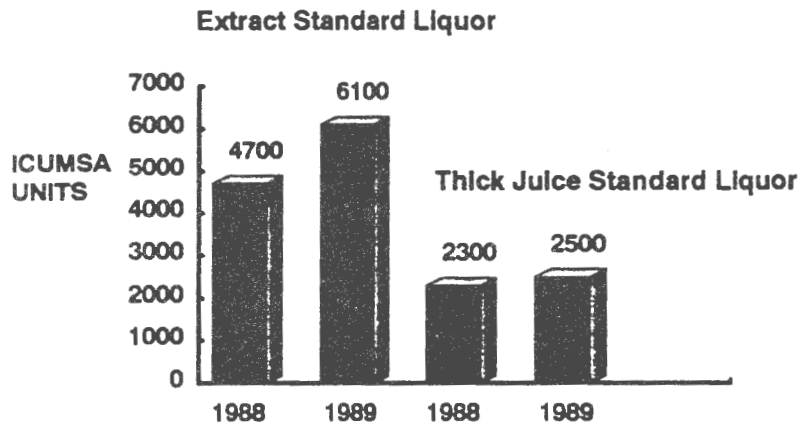
Color



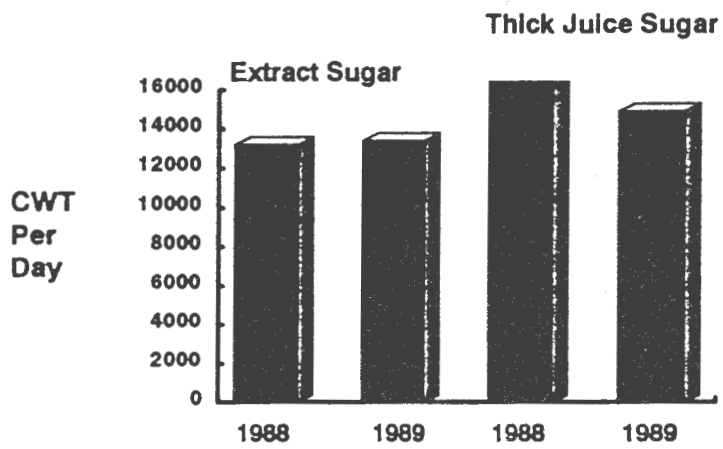
Centrifugal Wash Water - Seconds



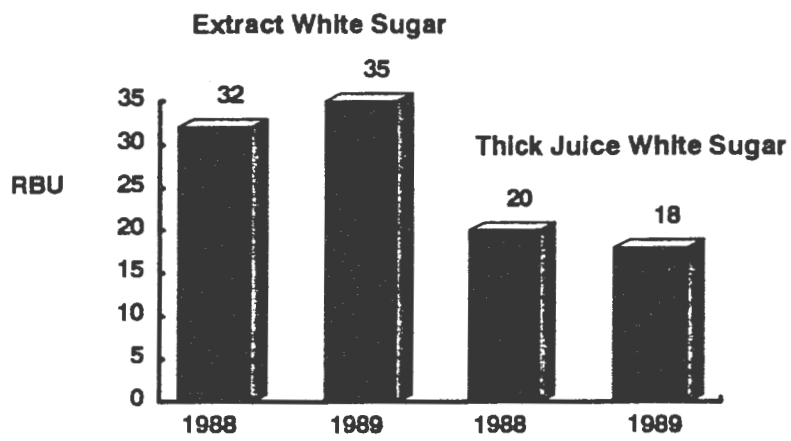
Color



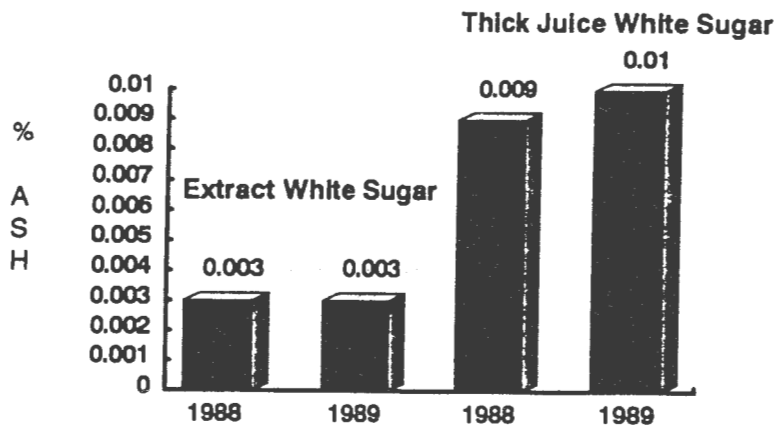
Daily White Sugar Production - CWT



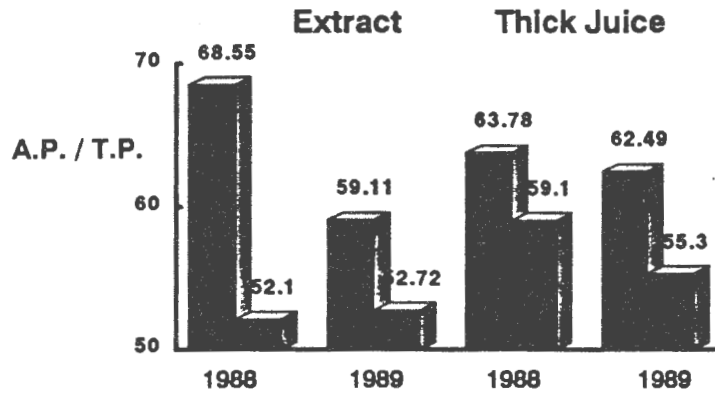
White Sugar Color



White Sugar % Ash



Molasses Purity



CONCLUSIONS

Extract from the TASC0 separator processed very comparably to thick juice.

No additional pre-treatment was required.

No equipment modifications were required.

This has allowed the separator to be utilized on a year round operational basis.