Technical Note

Energy Saving in Spirit Distillation

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A simplified continuous wine spirit distillation plant was designed with the aim of saving energy, constructed and subsequently tested under full operational conditions.

Duplication of the purification processes encountered in 6-column still operation was eliminated and the number of separate distillation columns reduced from six to four. The excellent separation of the alcohol from the impurities, achieved in a spacious purification column through adequate dilution of alcohol with water, is one of the outstanding characteristics of the adapted design. In addition, facilities for continuous caustic soda treatment of the impurities drastically reduced the percentage of feints.

During distillation a continuous production of high quality spirit, with the still operating at 99% efficiency, was achieved. Distillation of inferior quality wine had no adverse effect on the quality of the distillate. Losses were minimal and steam consumption was reduced from 6,9 kg/L Absolute Alcohol, to 4,9 kg/L AA produced. The percentage feints requiring redistillation was reduced from ca. 20% to 1,0%.

When conventional 6-column spirit stills are used, an average of 80% neutral spirit and 20% feints is normally produced at KWV distilleries. The final quantity of spirit eventually obtained is increased by treating the feints with caustic soda (NaOH) prior to triple redistillation thereof. Storage, handling and distillation losses are thus unavoidably high. In the existing 6-column stills, high boiling point purification and rectification is duplicated in order to obtain a pure neutral distillate. Nevertheless, experience has proven that quality may decrease especially with the distillation of either low quality wine, or of wine containing substantial quantities of sediment. In such an event even double high boiling point purification is inadequate. Under such circumstances, the energy requirements for spirit production, as well as the accompanying losses, are inevitably high.

Other than receiving wine for distillation to neutral spirit, the central KWV distillery also receives large quantities of predistilled raw wine spirit (at 90% alc/vol) from subsidiaries, which must be redistilled to neutral spirit.

In view of the high fuel prices it was decided to modify distillation techniques in order to:

(a) reduce the energy requirements.

(b) reduce the quantity of feints produced.

PROCEDURES

In order to achieve these aims without impairing the quality of the spirit produced, an adapted continuous distillation plant was developed. On designing the system attention was given to the following:

(a) The separation of high boiling and other impurities from the alcohol in a single purification column. To achieve this the dimensions of the column had to allow for dilution of alcohol to approximately 8% alc/vol.

(b) the inclusion of a continuous caustic soda treatment in order to remove SO_2, esters, acids, etc. which would reduce the volume of feints produced.

(c) the possible reduction of rectification levels as well as the restriction of the recirculation of impure fractions.

(d) the redistillation of raw spirits (90% alc/vol) at full strength thereby possibly eliminating the first column (eventually this could not be achieved).

The final design of a 4-column still incorporating most of the above requirements is shown in Fig. 1.

RESULTS AND DISCUSSION

Preheated wine (1) flows from the wine preheater to the upper plate of the wine column A. In this column raw spirits at approx. 95% alcohol is obtained and the heads, low oils and fusel oil fractions are also separated. The raw spirit is drawn off at (2).

In the purification column B, the raw spirit (2) is diluted with hot water (6). The impure fraction (7) is separated by means of high boiling point purification and subsequently flows to D1, while the ca. 8% alc/vol mixture (8) flows to the rectifying column C.

Purified alcohol (neutral spirit) is produced in the rectifying column C/C1 (9), while boiling water (6) is returned to column B for dilution purposes. The purity of the alcohol/water mixture fed to column C (the result of the dilution in B), reduces the need for high rectification levels. Volatile impurities (10) are conveyed to D1 and a high boiling fraction (11) is conveyed to D.

The heads (13) and the tails (14) are separated in D1 and collected as feints, whereas the fusel oil (12) is fed to the oil separator E. The remaining impure alcohol (15) flows from D1 to the bottom of F for caustic soda treatment (16). The removal of the heads and tails in D/D1 in conjunction with the caustic soda treatment of the impure fraction (15), results in a nearly complete separation.

In the fusel oil separator E, the water insoluble higher alcohols (17) are removed and the wash water (18) is returned to column D for further recovery of alcohol.

In column F the "alkali-reacting" impurities present in fraction (15) are removed by the caustic soda treatment. The impure alcohol (19) is evaporated, condensed and returned to A. The sediment formed in F is removed and added to the feints.

Aldehydes, propanol as well as other impurities present in lesser quantities, which do not react with caustic soda,

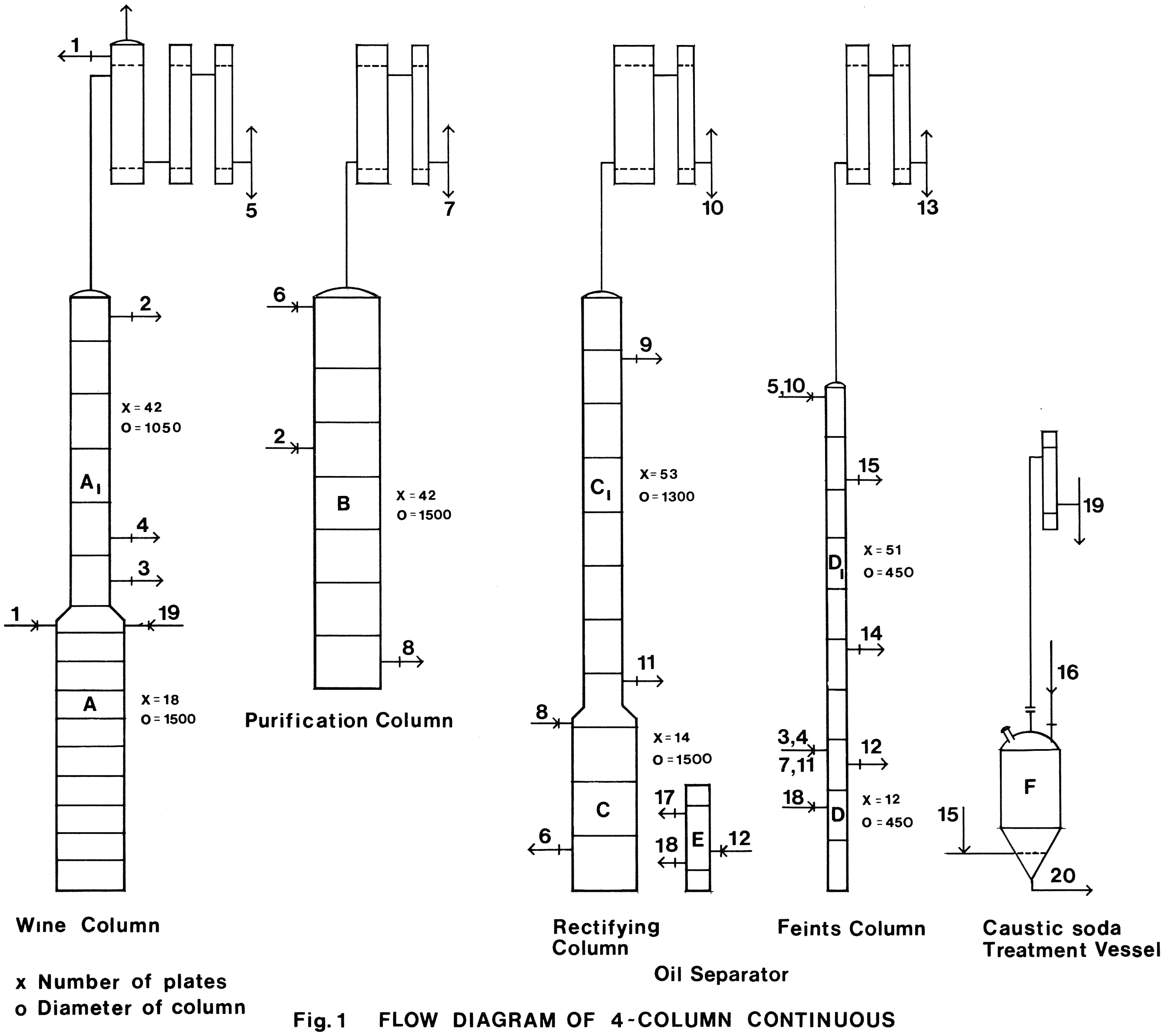

Fig. 1 FLOW DIAGRAM OF 4-COLUMN CONTINUOUS DISTILLATION PLANT

are removed as feints which does not exceed 1,0% in total.

Production records indicate that this design saves a substantial amount of energy. Steam consumption for wine distillation was reduced from 6,9 kg/L AA produced, to 4,9 kg/L—an energy saving of 29%. When re-distilling the raw spirit (90% alc/vol), (obtained in bulk from subsidiaries) the energy requirements of the adapted still, (when compared to that of a standard 6-column still), is 4,6 kg steam/L AA, as opposed to 6,9 kg. A saving of 33%.

The continuous caustic soda treatment removes virtually all the ''alkali reacting'' impurities and annual caustic soda requirements did not exceed that which was needed with the 6-column process.

The spirit produced complies organoleptically with the quality standards of the South African Brandy Board and, in addition, conforms to international analytical specifications.

Through the incorporation of recirculation facilities in the design, impure spirit produced during start-up procedures can be redistilled and purified without having to be collected in intermediate collecting vessels.

The high boiling point of the alcohol/water mixture in column B facilitates good separation. This makes it possible to remove various impurities, highly concentrated, from column A at (3), (4) and (5), as well as from column C1 at (10) and (11). Together with the caustic soda treatment, which eliminates nearly all the ''alkali reacting'' impurities, recirculation within the plant is reduced, and the quantity of feints produced, limited to approx. 1,0%. This results in an increased product yield as well as in substantial energy savings.

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Seasonal Uptake of Nutrients by Chenin blanc in Sand Culture: I. Nitrogen

Table 1 should read as follows

TABLE 1
Seasonal changes in dry mass of various fractions of Chenin blanc/99R grown in sand culture

Sampling date	Growth stage	Rootstock		Trunk		Roots		Shoots		Leaves		Bunches		Total (g/vine)	
		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	Actual	Corrected (3)
1975.08.08	Dormancy	43,3	21,2	28,1	13,8	132,6	65,0							204,0	
1975.09.04	Bud burst	35,2	17,8	26,9	13,5	136,2	68,7							198,2	
1975.09.26	Shoots 150 mm in length	41,2	20,0	36,4	17,6	112,9	54,7	*16,1*	*7,8*	(4)				206,5	
1975.10.20	Start bloom	40,9	17,1	34,7	14,5	93,0	38,9	31,0	13,0	39,2	16,5			238,9	
1975.11.10	End bloom	41,1	11,9	41,4	12,0	106,2	30,8	70,5	20,5	75,2	21,8	10,1	2,9	344,3	
1975.12.09	End of rapid shoot elongation	50,5	10,1	52,1	10,4	109,7	22,0	93,8	18,8	113,7	22,7	79,8	16,0	499,7	
1976.01.13	Véraison	49,8	6,5	55,7	7,3	143,8	18,7	118,1	15,4	125,0	16,2	275,2	35,9	767,4	
1976.02.17	Harvest	46,1	5,2	58,9	6,6	115,4	12,9	130,2	14,6	120,6	13,5	420,0	47,1	891,3	
1976.03.22	After harvest	62,0	6,0	66,0	6,4	193,8	18,8	163,7	15,8	127,6	12,4			612,9	1 032,9
1976.05.05	Start leaf fall	58,9	5,7	65,5	6,3	184,7	17,8	166,5	16,0	142,4	13,6			617,9	1 037,9
1976.06.23	End leaf fall	63,6	5,9	70,6	6,6	198,9	18,6	147,6	13,8	(169,7)	(15,9)			480,8	1 070,5
1976.08.06	Dormancy	66,8	6,2	73,7	6,9	199,7	18,6	141,4	13,2					481,6	1 071,3
1976.09.16	Bud burst	69,9	6,4	74,2	6,8	219,1	20,0							363,1	1 094,4
1976.10.21	Before bloom	66,4	5,9	79,2	7,0	187,5	16,6	*66,7*	*5,9*	(4)				399,7	1 130,9
LSD (5%)		6,3		8,1		20,4		14,4		14,8		40,2		98,0	98,0

(1): g/vine
(2): % of total mass
(3): Where applicable the total has been corrected for dry mass removed by the crop and lost through leaf fall and pruning.
(4): Leaves and shoots combined as one sample.