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Assessment of Hazardous Chemical in Sugar Industries Case Study: Assalaya Sugar Factory

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ABSTRACT

The main objective of this work is to evaluate effect of the additives used in the chemical treatment phase of the sugar production process.The environment of the industrial processes of the sugar industry contains the various chemicals (multipurpose and hazard grades), not from the additives before the start of industrial processes (fertilizers and pesticides in farm), through major materials in manufacturing processes (Calcium hydroxide and phosphoric acid), not finishing with auxiliary chemicals for different purposes (juice sterilizers, sedimentation aids,colorless materials, deodorants, etc.).Samples of Primary Juice, Mixed Juice, Clear Juice, Syrup and Final Molasses were collected during a three days , as representative of the whole farm. The concentration values of soluble solids and polarization were calculated in the Assalaya Sugar Factory, and the samples were collected in the laboratories of the Center for Industrial Research and Consultations, and were analyzed by the Atomic Absorption Spectrometry at the Ministry of Metals laboratories .With reference to "MSDS" and its components and the need to identify their parts while keeping a copy of them available to all workers in our environment.In order to maintain the safety of workers and machines, it was necessary to start focusing on the main materials in the industry and trace their effects in different stages of production, because they are closely related to the worker and the consumer.From the results obtained, it is necessary to study and analyze the soil of the farm to control the concentration of chemicals added with the use of clay cake as fertilizer and training the workers to control the amount of additives to be within the permissible range and training on the first aid methods with the rehabilitation of medical staff at the site.

Keywords: Assessment, Hazardous chemical, Sugar, Assalaya

1. INTRODUCTION

In chemical manufactures, processes have reactive chemicals and toxic or flammable liquid, vapors, gases and powders. Reactions of Chemical hazardous can occur at any stage of a process.

In an Occupational Safety and Health Administration is a major department in industrial environment. Its effects on employees and machines at the same times, so we must focus on it, from this point we start up.Operating units includes Batch or Semi-batch operating, Multi – purpose plant, Plant configurations that can be readily modified, a wide range of chemical reaction and Short production runs requiring quick response time. In these units there were several Sources of hazard: General hazards of the workplace, Health and environment hazard, toxicity and Eco-toxicity, Hazard associated with operations

not specific to a particular process (e.g. electrical equipment or welding), Hazard associated with chemical reactivity (chemical reaction hazards) and Hazard associated with flammable materials and the operation of plants (operational hazards) .

The types of hazard "special hazard in chemical manufacture" are chemical reaction hazards, Operational hazards, Toxic hazards and Environment hazards. Chemical reaction hazards could be: Thermally initiate decomposition, Rapid exothermic reaction, Rapid gas evolution, Controlling chemical reaction an associated hazard is an important aspect of chemical manufacture, Chemical manufacturing involves operations such as raw material storage, material transfer, and chemical reaction, isolated of product, drying, product preparation (milling, tableting, and otherwise formulating), packaging, product storage and transport .

2.1 Sugar

Carbohydrates are Organic compounds, It have alcoholic bound (-OH). Generally, called sugar to describe (Sucrose) solid crystal bi-saccharide Basic source is mono saccharide (exactly Glucose), derive energy for Brine and Blood Red Cells. Multi saccharide used on bone, teeth and water equilibrium as electrolyte equilibrium. Blood stores a certain amount of monosaccharaides as a permanent source of energy. Glycogen is always kept as a source of energy (liver and muscle). The excess sugar is converted into fat (lipid tissue).Monounsaturated sugars are burned in the body for energy use (50-60% energy), sometimes replaced with fats and proteins.

Carbohydrates + $O_2 \rightarrow H_2O\uparrow + CO_2\uparrow$ + Energy …… (2.1)

2.2.1 Clarification of juice:

There are more than 100's materials can be used in purification of juices. Put there are just five which are of any industrial importance: [3]

1. Lime (CaO) which, since the beginnings of sugar manufacture, has remained the universal basic defecant; the treatment with lime is called "defecation"
2. Phosphoric acid, from P_2O_5: "phosphatation"
3. Sulphurous acid, from SO_2: "sulphitation"
4. Carbonic acid, from CO_2: "Carbonation"
5. Magnesia MgO.

2.2.1.1 Clarification of juice using Lime:

In juice there are many of the organic acids are eliminated, since their lime salts are insoluble (oxalic, tartaric, etc.), part of the pectin and coloring matter is destroyed or rendered insoluble…, this elimination of impurities is relatively insignificant, the purity of the defecated juice being approximately the same as that of the juice before treatment.The quality of lime used is important. In many countries the only lime obtainable is very impure, approximately 60% CaO, containing much sand and unburnt stone. It is recommended that lime containing more than 2% of MgO or of oxides of iron and aluminum should be avoided. These impurities cause deposits in the multiple effects, and magnesia give trouble in the defecation.A good-quality lime should test 90-95% of CaO. Hydrated lime $Ca(OH)_2$, is also Employed, its activity being proportional to its CaO content (Pure hydrated lime contains 56/74 = 76% of CaO).

2.2.1.1.2 Milk of lime (MOL):

In some factories still use lime directly, adding it to the juice in the solid state: depended on solubility of lime in juice, it increases with the sugar content and decreases with increasing temperature. At 80°C (176°F), 0 .25-0.30% of CaO dissolves in a juice of 10-12% sucrose. It is advantage to make first a milk

of lime, by mixing the purified lime or lump quicklime with water. It is this milk of lime which will then be mixed with the juice; its mixing will be much more rapid and its action much more uniform. The milk of lime is made up in 2 tanks, one of which is emptied while the other is being filled (preparation and holding tanks). They are provided with a stirrer rotating according to the diameter of each one, capacity of each of them should correspond to "1 or 2 hours" operation of the factory. [3]Generally MOL made at 15° Baume. A density of 20°Be is not exceeded, as above this value the pumps and pipe lines block too frequently. When an automatic pH regulator, a milk of lime of 10°Be may be used for the fixed initial dose, a value of 5°Be should not be exceeded for the variable addition regulated by the automatic controller, otherwise control would be defective. It is often kept at 2 or 3°Be. Lime consumption: For the manufacture of raw sugar by ordinary defecation, one should allow for 0.5 -0.8 kg (1.1 - 1.8 lb.) of CaO per ton of cane. The aim should be to use the minimum of lime which will give good clarification and good settling, with a pH of clarified juice close to 7.0, since any excessive lime is harmful and results in an increase in the content of lime in clarified juice. Honig' estimates that, in a well-conducted defecation factory, the lime content of clarified juice should not exceed 400 mg/L.

2.2.1.1.3 Procedures of MOL:

1. Cold liming defecation:

The juice leaving the mills is generally at a pH in the neighborhood of 5.5. Lime is added to a pH of 7.2 - 8.3 and 35°C, most often to about 7.8.It is then pumped to heaters, the heating surface of which should be sufficient to bring the juice to its boiling point (100.5°C = 213°F). On leaving the heater, the juice passes into a vapor separator called flash tank, a simple tank placed in the pipe line, released to atmospheric pressure and returns to its corresponding boiling point and release of steam. It passes immediately afterwards to subsides, where the precipitate formed by the lime is settled, called clarifiers. The defecated juice, or clarified juice, drops to a variable pH, of the order of 6.8-7.Cold liming sufficient for the first two cases, when manufacturing raw sugar. When the juices are difficult to treat, the lime is increased to raise the pH to 8.3. [3]

2. Hot liming defecation:

Better clarification is often obtained by pumping the juice first to a heater heated by vapor bled from the second body of the multiple effects evaporators, so as to obtain a temperature of about (70°C = 160°F), and then proceeding to add the lime to the same pH value 7.8 and finally heating further up to (103°C = 218°F). Hot liming, according to Jenkins, requires 15 - 20% less lime, for a better clarification. [3]

3. Fractional liming with double heating defecation (ASF working by this method):

This process has been recommended and put into operation at the College of Tropical Agriculture in Trinidad. It is intended especially for treatment of refractory juices, and generally gives a substantial improvement when the ordinary liming becomes insufficient. It consists of: Liming the cold juice to a pH of 6.2 - 6.4, Heating to boiling , Re-liming to a pH of 7.6 - 8.2 , Heating again to boiling , Leaving to settle. The first heating may be taken only to (75°C).

The second liming may be taken beyond 8.2, but the optimum value is generally in the neighborhood of 7.8. If the juice is limed to 8.4, the defecated juice remains alkaline.

It is imperative that the second heating should exceed the boiling point, and it will be preferable to insist on 104 .5°C. The final pH of the clarified juice should be about 6.8 - 7.1. Advantages of fractional liming with double heating than cold liming: Less scum is obtained, Clarified juice is much more brilliant, Muds filter better, Giving dry and porous cakes, Nitrogenous colloids are separated to a much greater extent, Waxes are eliminated in a still greater proportion. [3]

2.2.1.1.4 Liming while boiling:

This consists of liming the juice, not at 70°C, but after heating and boiling at 100.5°C. The heated juice is pumped to a tank above the clarifiers, and the milk of lime is also pumped in such a way as to obtain a complete and homogeneous mixture with the juice. From this tank, the juice flows by gravity into the clarifiers. No time of contact is provided, this being assured in the flocculation chamber of the clarifier. It is necessary to cool the continuous sample of juice taken for the pH recorder-controller. [3]

2.2.1.1.5 Java method:

According to Honig', promised in 1939 to become general in Java:

Pre-liming of the juice to between pH 6.0 and 6.6 then Separation of the pre-limed juice into 2 portions (40% limed cold to pH 9.5 and 60% heated) and Mixing of the 2 portions, giving a pH of 7,6-7.8 and a temperature of 65°C. [3]

2.2.1.1.6 Lime addition with saccharate:

This method of liming has been used in Australia, Mauritius and Reunion, and recently in South Africa. It consists of mixing the milk of lime with clear juice or syrup, maintaining it in contact for up to 5 minutes to give time for the saccharate to form, and the lime addition to the juice is then made with this mixture. It is necessary that the lime should be in the monocalcium saccharate form, and for this the temperature must be lower than 58°C and the ratio of sucrose to CaO should be above 6.1:1.The quality of milk of lime depended on Concentration and purity of calcium oxide, Concentration of the prepared solution and weight, at increase pH viscosity increases due to deformation of Sucrose, Glucose and Fructose so Acrylic materials increase in acidic condition. Juice for the mixture may be the cloudy filtrate from the vacuum filters; this may resolve, at least partially, the problem of disposal of that filtrate.This avoids all risk of loss by inversion, which is possible in the case of juices at pH 6.9. On the other hand, alkaline juice slows down the work at the pans, and crystallization is less easy. For a pH of 7.5, boiling times 20:10 longer may be expected compared with a pH of 7.0. [3]SO_2, P_2O_5, CO_2 and MgO, the following reagents are also used in various parts of the world: [3]

1. Soda ash (sodium carbonate): It may be advantageous to replace part of the lime it when it is necessary to treat canes where the juice has been affected by frost or by a long delay in the field after cutting, or burnt cane which has been delayed in transport, or generally cane with abnormal juice.
2. Bentonite (aluminum magnesium silicate): which has similarly been added in clarification in Puerto Rico, where certain factories have expressed complete satisfaction with it.
3. Sepran AP 30 (POLYACRYLAMIDE): This is a coagulant added to the juice before clarifying or to the mud before filtration. It is expensive, but appears to improve the clarity of the juice and the substitution.It forms an integral part of the Rapi-Floc process. In present practice, it is used in the proportion of 1 -3 ppm. (Normal juice, 0.1-0.2 ppm. (to improve capacity), Refractory juices 1.5 ppm, Maximal usage 3 ppm.

2.2.1.2 Clarification with Phosphoric Acid (phosphatation)

Phosphoric acid in the cane in two principal forms: Soluble phosphates of the juice and in combination as protein in the cell material.The latter compounds being insoluble, only the soluble phosphates take part in the defecation. Both forms react with the lime and form a precipitate which constitutes an important part of the floc produced in the juice by the lime. It has been shown that the greater the amount of phosphoric acid in the juice, the easier is the clarification. The mean phosphate content of normal juice is approximately (100 – 150 p.p.m) P_2O_5 per liter.Unfortunately, certain varieties of cane give a juice poor in phosphoric acid, and which is difficult to treat "refractory", to improve by adding

before defecation. The necessary quantity of phosphoric acid to add: It is depending on the variety of cane and the circumstances. It is considered in general that at least (300 – 350 p.p.m) of P_2O_5 per liter of juice. [3]

Action of phosphoric acid on the juice:

The phosphoric acid added to the juice precipitates part of the colloids and coloring matter which it contains. The precipitate with lime is mainly tricalcium phosphate. This unfortunately is a gelatinous precipitate and difficult to filter. A form in which phosphoric acid is used Phosphoric acid is available commercially for use in the sugar factory in powder or paste form. Failing these, ordinary superphosphate or dicalcium phosphate may be used. They are diluted to form a solution of 12° or 15° Baume. [3]

2.2.1.2.1 Methods of clarification using Phosphoric acid:

Phosphoric acid will be added before liming. Then follows the clarification process which has been adopted.Clarification with Phosphoric Acid:To add more lime, in order to neutralize the added acid, this will have reduced the original pH of the juice, generally about 5.5, to 4.5 or 4.6 for an average dose. Phosphoric acid clarification may without difficulty be combined with sulphitation. [3]To improves the clarification of refractory juices. It often permits of eliminating the sulphitation. It is possible to a certain extent, to replace Sulphurous by phosphoric acid. It is much less expensive than sulphitation, does not require special equipment, avoids corrosion of plates and pipes, and reduces scaling at heaters and multiple effects. However, phosphoric acid should rather be regarded, not as a replacement, but as an adjunct to the clarification, which should be considered when exceptional difficulties are encountered in filtration. [3]

2.2.1.3 Clarification with Sulphurous acid (Sulphitation)

Defecation is a universal and indispensable process. With sulphitation it is different; most of the world's sugar factories do without it. But it is the most widespread process auxiliary to defecation. Either eliminates coloring matters (a property common to all acids) or It reduces to colorless compounds the ferric salts which have been formed by contact with mills, tanks and pipes. Sulphur dioxide is prepared from sulphur, which is delivered in the form of small sticks or cylinders. [3]

Sulphur dioxide is a gas resulting from the combustion of sulphur : [3]

$S + O_2 \rightarrow SO_2$ ……... (2-4)

$SO_2 + O_2 \rightarrow SO_3$ ……... (2-5)

This reaction begins to be noticeable above 900°C. To remove any sulphuric acid which may have formed, the gas is generally washed by bubbling through water. [3]

2.2.1.3.1 Advantages and disadvantages of clarification with Sulphurous acid:

At high acidity (pH 3.8 - 4.0) and low temperature (30 - 40°C) and at low acidity (pH 5.1 - 5.3) and high temperature (70 - 75°C).Advantages: Juice settles more rapidly, the massecuites are less viscous and boil faster. Better crystallization in consequence, marked improvement in color of the sugar, savings in time in clarification and boiling, slight gain in capacity of centrifugal and better elimination of phosphates and waxes leading to better refining quality and filterability of the sugar produced.Disadvantages: much heavier deposits in heaters these may be avoided by sulphiting hot but this involves an increase in the heating surface required, higher ash content of the sugar obtained and greater expense (Quartz, circulation pump, sulphur, corrosion of vessels and pipes, etc.). [3]

2.2.1.4 Clarification with Carbonic acid (Carbonatation):

Carbonatation was originated in the beet sugar factory by Perier and Possoz in 1859. They reported that,

if a precipitate of calcium carbonate be formed in the juice, it entraps coloring matter and gums, if the reaction remains alkaline, and thus furnishes a marked additional degree of clarification. [3]

$CO_2 + Ca(OH)_2 \rightarrow CaCO_3 + H_2O$ …….. (2-6)

The same reaction has been utilized in the cane sugar factory.

2.2.1.4.1 Methods of clarification using Carbonic acid:

There are various ways put the most important of which are: Single Carbonatation, Double Carbonatation, De Haan Carbonatation, and Middle-juice Carbonatation. Carbonatation leaving a very high alkalinity. There is formed by the lime, the CO_2 and the juice, a sucro-carbonate of lime: $C_{12}H_{22}O_{11}$, $3CaCO_3$, $2Ca(OH)_2$ which is gelatinous and insoluble, and would hold a large quantity of sugar in combination. [3]Suppressing the frothing and avoiding the formation of the gelatinous sucro-carbonate. The juice is heated to 55°C in the heaters and sent to the carbonating tanks. Gas is introduced at the same time as the milk of lime is run in, so maintaining the pH at a content value. This process permits of a substantial economy in space, while increasing the capacity of the heaters, and giving a marked economy in lime consumption, with a slight rise in purity, and gives a better quality sugar. [3]

Table (2.3): Materials used for the various clarification methods (kg/t .c., * 2.2 for lb./t.c.) [3]

	CaO	Limestone	Coke	Sulphur	P_2O_5
Sulphitation	0.8-1.5	-	-	0 .5	
Sulphitation and phosphoric acid	1	-	-	0.1	0.1
Single Carbonatation	18	35	4	0.2	
Continuous double Carbonatation	18	35	4	0.2	
Ordinary double Carbonatation	20-23	40-45	4.4	0.2	
De Haan Carbonatation	12	23	2.5		
Middle-juice Carbonatation	9	20	2		

2.2.1.5 Clarification of juice using Magnesia:

Is similar to that of lime, but it has often stated that magnesia (powdered of magnesium oxide) was undesirable and that it was important to avoid the use in defecation of lime containing more than a certain proportion of magnesia. Due to the lower molecular weight, 1 kg of magnesium oxide (MgO) replaces 1.390 kg of quicklime (CaO), or 1.837 kg of hydrated lime $Ca(OH)_2$. The best results are obtained when 50-80% of the lime is replaced by the corresponding quantity of MgO. [3]

2.2.1.5.1 Method of clarification using Magnesia:

On processes operation in sugar factories, there are several chemicals used as shown on this list (but in this research, we will focus on first and second compounds): Calcium Hydroxide (Milk of lime): net Wt. = 25kg and Phosphoric Acid: 85%, food grade, net Wt. = 35 Kg

Sepran : Flocculent (HENGFLOC 62018WG POLYACRYLAMIDE) , 25kg , Sodium Hydroxide (Caustic Soda) , Sodium Sulphate (Soda Ash) , Sodium tri Phosphate , Aluminum Sulphate : ALUMINIUMS $(Al_2(SO_4)_3.nH_2O)$, when n = 14-18 ,, 40 Kg , Hydrochloric Acid , Acid Inhibiter , Hodag , Blanket , Talofloc , Taloflote 100 : Anionisch POLYACRYLAMIDE , Sodium Chloride , Resin , Activated Carbon , Biocide Mill Sanitation , Chlorine Gas. [3]

3.2 Apparatus:

- Hydrometer Brix (cover the required range: range 40-50 in 1/10°, thermometer enclosed)
- Thermometer

- Brix jar
- Hydrometer cylinder: 375 mm high, 50 mm diameter.
- Saccharimeter and Pol Tube 200 mm
- Stoppard bottle (225 cm)
- Stainless steel Funnel (100 mm)
- Tall from beaker (250 cm)
- Water glass (100 cm)
- Filter paper: whatman No.91 (185 mm)
- Balance (Sensitive Balance), heavy duty.
- Source of vacuum.
- Oven
- Discater & Jar
- Stop watch
- Conical flask & Volumetric flask
- Graduated cylinder
- Water bath & Heater

3.3 Methods:

Table (3.1): Correction method of brix

Hydrometer reading	13.80
Hydrometer calibration correction	0.10
True hydrometer reading	13.70
Temperature	24.70
Temperature correction (from table)	0.29
Correction brix	13.99

Table (3.2): Correction method of Pol%

Saccharimeter reading	35.85
Temperature	27°C
Brix% juice at 20 °C	10.59
The adjustment for 27°C	0.42
The adjustment brix reading	10.17
From Schmitz's table, pol% juice using a brix reading of 10.17 and Saccharimeter reading of 35.85	8.97

Correction method of FM:

- If the hydrometer carries a correction certificate, apply the correction to the reading.
- Correct the hydrometer reading to 27°C from the standard temperature correction table.
- 1:1 Brix of the original molasses equals the result *2.

Table (3.3): Correction method of FM

Hydrometer reading	4305
Temperature of solution	28.0 °C
Hydrometer correction	0.1
43.35-0.1	43.25
Temperature correction	0.04
43.25+0.04	43.29
1:1 Brix = 43.29	86.58

4. Results and Discussion

4.1 Results:

This study was conducted during the period (16/12/2017 - 21/12/2017) as the middle of the production season. Routine analyzes (six samples within six days) were done on the samples of Primary Juice, Mixed Juice, Clear Juice, Syrup, Final Molasses and Filter Cake (Concentration of soluble total solids (Bx), Polarization value (Pol), purity (pty), humidity and pH).Samples of Primary Juice, Mixed Juice, Clear Juice, Syrup and Final Molasses were collected during a three days (17/12/2017, 18/12/2017, 19/12/2017), as representative of the whole farm (compatibility of the germination environment and the amount of fertilizer added).The concentration of soluble total solids and polarization value were calculated in the ASF. The samples were prepared in laboratories of the Industrial Research and Consultations Center and were analyzed by the Atomic Absorption Spectrometry (AAS) at the chemical laboratory of Ministry of Minerals to calculate the concentration of calcium ions within three days.Primary Juice (ISSCT) (PJ): all the juice expressed before dilution being. In most mills this is the combined crusher and first-mill juice [6].

Mixed Juice (ISSCT) (Dilute Juice) (MJ): The juice sent from the crush-plant to the boiling house [6].Clarified Juice (ISSCT) (Defecated Juice) (CJ): The juice from the clarifier [6].Syrup (ISSCT) (Sy): The concentrated juice from the evaporators, before crystallization [6].Final Molasses (ISSCT) (blackstrap) (FM): The liquid residue from which no more sugar can be removed economically [5].Sugar (Su): main product from sugar plant, consist of Sucrose and several impurities.Filter Cake (FC): The solid residue from rotary vacuum filters which came from clarifiers (no more sugar can be removed by forced).Reducing Sugar (ISSCT) (RS): The reducing substances in cane and its products, calculated as invert sugar [6].

Table (4-1): Daily report from 16/12/2017 – 21/12/2017

Date	Sample	Corr Bx	Pol %	Purity	Mois	pH
16/12	Pj	19.16	16.70	87.16	##	##
	Mj	15.73	13.40	85.19	##	5.48
	Cj	13.85	11.82	85.34	##	7.30
	Sy	56.23	47.70	84.83	##	6.70
	FM	94.45	34.87	36.92	##	##
	FC	##	2.75	##	68.17	##
17/12	Pj	19.40	16.76	86.39	##	##
	Mj	16.54	13.94	84.28	##	5.47

	Cj	13.68	11.55	84.43	##	7.38
	Sy	57.73	48.80	84.53	##	6.60
	FM	93.56	43.50	36.87	##	##
	FC	##	2.90	##	68.00	##
18/12	Pj	19.06	16.66	87.41	##	##
	Mj	15.71	13.41	85.36	##	5.46
	Cj	13.48	11.53	85.53	##	7.42
	Sy	55.69	47.20	84.75	##	6.40
	FM	94.20	34.37	36.40	##	##
	FC	##	2.75	##	67.83	##
19/12	Pj	18.71	16.11	86.10	##	##
	Mj	15.87	13.37	84.25	##	5.40
	Cj	13.48	11.37	84.35	##	7.20
	Sy	52.12	43.90	84.23	##	6.55
	FM	94.30	34.63	36.72	##	##
	FC	##	2.80	##	68.03	##
20/12	Pj	20.29	17.39	85.71	##	##
	Mj	16.58	13.88	83.72	##	5.43
	Cj	13.43	11.27	88.92	##	7.30
	Sy	95.24	49.70	83.95	##	6.55
	FM	93.64	34.40	36.74	##	##
	FC	##	2.85	##	67.95	##
21/12	Pj	19.34	16.74	86.56	##	##
	Mj	16.03	13.53	84.40	##	##
	Cj	14.16	11.96	84.46	##	##
	Sy	53.54	45.25	84.52	##	6.45
	FM	94.76	34.63	36.54	##	##
	FC	##	2.95	##	49.98	##

Table (4-2): Daily report 16/12/2017

Date	Sample	Corr Bx	Pol %	Purity	Mois	pH
16/12	Pj	19.16	16.70	87.16	##	##
	Mj	15.73	13.40	85.19	##	5.48
	Cj	13.85	11.82	85.34	##	7.30
	Sy	56.23	47.70	84.83	##	6.70
	FM	94.45	34.87	36.92	##	##
	FC	##	2.75	##	68.17	##

Table (4-3): Daily report 17/12/2017

Date	Sample	Corr Bx	Pol %	Purity	Mois	pH
17/12	Pj	19.40	16.76	86.39	##	##
	Mj	16.54	13.94	84.28	##	5.47
	Cj	13.68	11.55	84.43	##	7.38
	Sy	57.73	48.80	84.53	##	6.60
	FM	93.56	43.50	36.87	##	##
	FC	##	2.90	##	68.00	##

Table (4-4): Daily report 18/12/2017

Date	Sample	Corr Bx	Pol %	Purity	Mois	pH
18/12	Pj	19.06	16.66	87.41	##	##
	Mj	15.71	13.41	85.36	##	5.46
	Cj	13.48	11.53	85.53	##	7.42
	Sy	55.69	47.20	84.75	##	6.40
	FM	94.20	34.37	36.40	##	##
	FC	##	2.75	##	67.83	##

Table (4-5): Daily report 19/12/2017

Date	Sample	Corr Bx	Pol %	Purity	Mois	pH
19/12	Pj	18.71	16.11	86.10	##	##
	Mj	15.87	13.37	84.25	##	5.40
	Cj	13.48	11.37	84.35	##	7.20
	Sy	52.12	43.90	84.23	##	6.55
	FM	94.30	34.63	36.72	##	##
	FC	##	2.80	##	68.03	##

Table (4-6): Daily report 20/12/2017

Date	Sample	Corr Bx	Pol %	Purity	Mois	pH
20/12	Pj	20.29	17.39	85.71	##	##
	Mj	16.58	13.88	83.72	##	5.43
	Cj	13.43	11.27	88.92	##	7.30
	Sy	95.24	49.70	83.95	##	6.55
	FM	93.64	34.40	36.74	##	##
	FC	##	2.85	##	67.95	##

Table (4-7): Daily report 21/12/2017

Date	Sample	Corr Bx	Pol %	Purity	Mois	pH
21/12	Pj	19.34	16.74	86.56	##	##
	Mj	16.03	13.53	84.40	##	##
	Cj	14.16	11.96	84.46	##	##
	Sy	53.54	45.25	84.52	##	6.45
	FM	94.76	34.63	36.54	##	##
	FC	##	2.95	##	49.98	##

Table (4-8): Concentration of Ca^{+2} in ppm

No. of sample	Sample	Ca^{+2} con. (ppm)	Average Ca^{+2} con. (ppm)
1	Pj	15.96	8.13
2		6.74	
3		1.68	
4	Mj	6.38	7.07
5		1.88	
6		12.96	
7	Cj	24.52	27.45
8		31.7	
9		26.14	
10	Sy	1110.4	585.2
11		60.0	
12	FM	119.8	539.3
13		958.8	
14	MOL	1463.6	1463.6
15	FC	483.6	577.2
16		670.8	
17	Su	96.76	96.76

Table (4-9): Concentration of Ca^{+2} in ppm (17/12/2017)

Sample sorted by a day	Ca^{+2} con. (ppm)
Pj – 1	15.96
Mj – 1	6.38
Cj – 1	24.52

Table (4-10): Concentration of Ca^{+2} in ppm (18/12/2017)

Sample sorted by a day	Ca^{+2} con. (ppm)
Pj – 2	6.74
Mj – 2	1.88
Cj – 2	31.7

Table (4-11): Concentration of Ca^{+2} in ppm (19/12/2017)

Sample sorted by a day	Ca^{+2} con. (ppm)
Pj – 3	1.68
Mj – 3	12.96
Cj – 3	26.14

Table (4-12): Concentration of P_2O_5 in ppm

Sample	P_2O_5 in	P_2O_5 out
Mixed Juice	168	316
	153	310
	148.12	288.24
	154.47	295.81

- During three days (as so as all seasons):
  1. Concentration of P_2O_5 in: with range 150 ppm – 200 ppm
  2. Concentration of P_2O_5 out: with range 300 ppm – 350 ppm
- This range effective and depended on fertilizes

5.1 Conclusions

In this study, it was confirmed that all methods of sampling conform to the methods of the International Commission for Uniform Methods of sugar Analysis (ICUMSA) and South African system in the manufacture and control of the quality of sugar produced, as well as all tests.After all data result: Concentration of Ca^{+2}: decreases from PJ to MJ then increases in CJ, Brix value: decreases from PJ, MJ till CJ. After that increases from Sy till FM, Pol value: decreases from PJ, MJ till CJ. after that increases in Sy then increases again in FM, Purity value: decreases and increases depended on Brix & Pol (PJ, MJ till CJ . and in Sy till FM. Pol in FC most be very less (main source of losses), and it moisture too. Sugar : Pol must be less than 99.30%, RS less than 0.30%, Ash less than 0.40%, Color less than 1500 ICUMSA, pH less than 7.2 to 6.8 and non-dissolved mater less than 0.03%.Also, the results and values of the sugar analyzes produced from ASF were also reviewed and monitored. Then we found to conform to the Sudanese standards for High Pol Raw Sugar (in terms of homogeneity of crystals, polarization degrees, reduced sugar, ash, moisture, color scale, pH and non-dissolved matter). Production according to the Codex Committee and General Principles for Food Health.As that, additive chemicals were within the allowable range in the industry, and then the concentrations of the materials under study were within the allowable range in the final product.

5.2 Recommendations

1. Study and analysis of the soil of the farm to re-define and control the amounts and concentrations of

the added fertilizers (using the filter cake "FC" to addition it to soil with a few chemicals added)
2. Training all workers in the site and different sections on the methods of prevention and methods of protection and first aid, especially when exposure to toxic chemicals used + when exposed.....
3. Train medical personnel and medical staff to assist in the rapid intervention in the case of poisoning with a certain chemical available within the scope of work.

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