Natural polymers of sugars biology essay

Science, Biology

\n[toc title="Table of Contents"]\n

\n \t

\n[/toc]\n \nINTRODUCTIONThe generalised name for a class of sweet-flavored substances used as food is Sugar. They are carbohydrates and are composed of carbon, hydrogen and oxygen. The various types of sugar derived from different sources as simple sugars are called monosaccharides and include glucose fructose and galactose. The granulated sugar most customarily used as food is sucrose, a disaccharide and disaccharides include maltose and lactose. Sugars are found in the tissues of most plants but are only present in sufficient concentrations for efficient extraction in sugarcane and sugar beet. Sugarcane is a giant grass and has been cultivated in tropical climates in the Far East since ancient times. A great expansion in its production took place in the 18th century with the setting up of sugar plantations in the West Indies and Americas. This was the first time that sugar became available to the common people who had previously had to rely on honey to sweeten foods. Sugar beet is a root crop and is cultivated in cooler climates and became a major source of sugar in the 19th century when methods for extracting the sugar became available. Sugar production and trade has changed the course of human history in many ways. It

influenced the formation of colonies, the perpetuation of slavery, the transition to indentured labour, the migration of peoples, wars between 19th century sugar trade controlling nations and the ethnic composition and political structure of the new world. The world produced about 168 million tonnes of sugar in 2011. The average person consumes about 24 kilograms of sugar each year 33. 1 kg in industrialised countries), equivalent to over 260 food calories per person, per day. Sugar provides empty calories. Since the latter part of the twentieth century, it has been questioned whether a diet high in sugars, especially refined sugars, is bad for health. Sugar has been linked to obesity and suspected of being implicated in diabetes, cardiovascular disease, dementia, macular degeneration and tooth decay. Numerous studies have been undertaken to try to clarify the position but the results remain largely unclear, mainly because of the difficulty of finding populations for The etymology reflects the spread of the commodity. The English word " sugar1 originates from the Arabic word sukkar which came from the Persian shekar, 2 itself derived from Sanskrit śarkarā. 3 It most probably came to England by way of Italian merchants. The contemporary Italian word is zucchero, whereas the Spanish and Portuguese words, azúcar and açúcar respectively, have kept a trace of the Arabic definite article. The Old French word is zuchre – contemporary French sucre. The earliest Greek word attested is σάκχαρις (sákk^{h}aris). 4, 5 A satisfactory pedigree explaining the spread of the word has yet to be done. The English word jaggery, a coarse brown sugar made from date palm sap or sugar cane juice, has a similar etymological origin; Portuguese xagara or jagara, derived from Malayalam cakkarā from the Sanskrit śarkarā. 6 Sugar has been produced in

the Indian subcontinent7 since ancient times. It was not plentiful or cheap in early times and honey was more often used for sweetening in most parts of the world. Originally, people chewed raw sugarcane to extract its sweetness. Sugarcane was a native of tropical South Asia and Southeast Asia.[8] Different species seem to have originated from different locations with Saccharum barberi originating in India and S. edule and S. officinarum coming from New Guinea. 8, 9One of the earliest historical references to sugarcane is in Chinese manuscripts dating back to 8th century BC which mention the fact that the use of sugarcane originated in India. 10 It appears that in about 500 BC, residents of present-day India began making sugar syrup and cooling it in large flat bowls to make crystals that were easier to store and transport than the cane itself. In the local Indian language, these crystals were called khanda , which is the source of the word candy. 11Sugar remained relatively unimportant until the Indians discovered methods of turning sugarcane juice into granulated crystals that were easier to store and to transport. 12 Crystallized sugar was discovered by the time of the Imperial Guptas, around 5th century AD. 12 Indian sailors, who carried clarified butter and sugar as supplies, introduced knowledge of sugar on the various trade routes they travelled. 12 Buddhist monks, as they travelled around, brought sugar crystallization methods to China. 13 During the reign of Harsha (r. 606–647) in North India, Indian envoys in Tang China taught methods of cultivating sugarcane after Emperor Taizong of Tang (r. 626–649) made his interest in sugar known. China then established its first sugarcane plantations in the seventh century. 14 Chinese documents confirm at least two missions to India, initiated in 647 AD, to obtain technology for sugar-

refining. 15 In South Asia, the Middle East and China, sugar became a staple of cooking and desserts. The triumphant progress of Alexander the Great was halted on the banks of the Indus River by the refusal of his troops to go further east. They saw people in the Indian subcontinent growing sugarcane and making granulated, salt-like sweet powder, locally called Sharkara . On their return journey, the Macedonian soldiers carried the " honey bearing reeds" home with them. Sugarcane remained a little known crop in Europe for over a millennium, sugar a rare commodity, and traders of sugar wealthy. 16Crusaders brought sugar home with them to Europe after their campaigns in the Holy Land, where they encountered caravans carrying " sweet salt". Early in the 12th century, Venice acquired some villages near Tyre and set up estates to produce sugar for export to Europe, where it supplemented honey which had previously been the only available sweetener. Crusade chronicler William of Tyre, writing in the late 12th century, described sugar as " very necessary for the use and health of mankind".[17] In the 15th century, Venice was the chief sugar refining and distribution centre in Europe. 17 In August 1492, Christopher Columbus stopped at La Gomera in the Canary Islands, for wine and water, intending to stay only four days. He became romantically involved with the Governor of the island, Beatriz de Bobadilla y Ossorio, and stayed a month. When he finally sailed she gave him cuttings of sugarcane, which became the first to reach the New World. 18Sugar was a luxury in Europe prior to the 18th century when it became more widely available. It then became popular and by the 19th century it was considered a necessity. This evolution of taste and demand for sugar as an essential food ingredient unleashed major economic and social changes.

19 It drove, in part, colonization of tropical islands and nations where labor-intensive sugarcane plantations and sugar manufacturing could thrive. The demand for cheap and docile labor to perform the hard work involved in its cultivation and processing drove first, the slave trade from Africa (in particular West Africa), followed by the indentured labor trade from South Asia (in particular India). 20, 21, 22 Millions of slave and indentured laborers were brought into the Caribbean, Indian Ocean, Pacific Islands, East Africa, Natal, north and eastern parts of South America, and southeast Asia. The modern ethnic mix of many nations that have been settled in the last two centuries has been influenced by sugar. 23, 24, 25Sugar also led to some industrialization of former colonies. For example, Lieutenant J. Paterson, of the Bengal establishment, persuaded the British Government that sugar cane could be cultivated in British India with many advantages and at less expense than in the West Indies. As a result, a number of sugar factories were established in Bihar in eastern India. 26During the Napoleonic Wars, sugar beet production increased in continental Europe because of the difficulty of importing sugar at times in which shipping was subject to blockade. By 1880, sugar beet was the main source of sugar in Europe though the United Kingdom continued to import the main part of its sugar from its colonies. 27Until the late nineteenth century, sugar was purchased in loaves, which had to be cut using implements called 'nips', 28 while in later years bags of sugar became more common. The first inventor of a process to make sugar in cube form was Moravian Jakub Kryštof Rad, director of a sugar company in Dačice where sugar cube production began when he was granted a five-year patent for the invention on January 23,

1843. Henry Tate of Tate & Lyle was another early manufacturer of sugar cubes at his refineries in Liverpool and London. Tate purchased a patent for sugar cube manufacture from German Eugen Langen, who had invented a different method of processing of sugar cubes in 1872. 29Scientifically, sugar loosely refers to a number of carbohydrates, such as monosaccharides, disaccharides, or oligosaccharides. Monosaccharides are also called " simple sugars," the most important being glucose. Almost all sugars have the formula CnH2nOn (n is between 3 and 7). Glucose has the molecular formula C6H12O6. The names of typical sugars end with "-ose," as in " glucose", " dextrose", and " fructose". Sometimes such words may also refer to any types of carbohydrates soluble in water. The acyclic mono- and disaccharides contain either aldehyde groups or ketone groups. These carbon-oxygen double bonds (C= O) are the reactive centers. All saccharides with more than one ring in their structure result from two or more monosaccharides joined by glycosidic bonds with the resultant loss of a molecule of water (H2O) per bond. 30Magnification of grains of refined sucrose, the most common free sugarMonosaccharides in a closed-chain form can form glycosidic bonds with other monosaccharides, creating disaccharides (such as sucrose) and polysaccharides (such as starch). Enzymes must hydrolyze or otherwise break these glycosidic bonds before such compounds become metabolized. After digestion and absorption the principal monosaccharides present in the blood and internal tissues include glucose, fructose, and galactose. Many pentoses and hexoses can form ring structures. In these closed-chain forms, the aldehyde or ketone group remains non-free, so many of the reactions typical of these groups cannot

occur. Glucose in solution exists mostly in the ring form at equilibrium, with less than 0. 1% of the molecules in the open-chain form. 30

Natural polymers of sugars

Biopolymers of sugars are common in nature. Through photosynthesis plants produce glucose, which has the formula C6H12O6, and convert it for storage as an energy reserve in the form of other carbohydrates such as starch, or (as in cane and beet) as sucrose, with the chemical formula C12H22O11. Starch, consisting of two different polymers of glucose, is a readily degradable form of chemical energy stored by cells, and can be converted to other types of energy. Another polymer of glucose is cellulose which is a linear chain composed of several hundred or thousand glucose units. It is used by plants as a structural component in their cell walls. Humans can only digest cellulose to a very limited extent, though ruminants can do so with the help of symbiotic bacteria in their gut. 31 DNA and RNA are built up of the monosaccharides deoxyribose and ribose respectively. Deoxyribose has the formula C5H10O4 and ribose the formula C5H10O5. 32

Types of sugar

Monosaccharides

Glucose, fructose and galactose are all simple sugars, monosaccharides, with the general formula C6H12O6. They have five hydroxyl groups (−OH) and a carbonyl group (C= O) and are cyclic when dissolved in water. They each exist as several isomers with dextro- and laevo-rotatory forms which cause polarized light to diverge to the right or the left. 33Glucose, dextrose or grape sugar occurs naturally in fruits and plant juices and is the primary

product of photosynthesis. Most ingested carbohydrates are converted into glucose during digestion and it is the form of sugar that is transported round the bodies of animals in the bloodstream. It can be manufactured from starch by the addition of enzymes or in the presence of acids. Glucose syrup is a liquid form of glucose that is widely used in the manufacture of foodstuffs. It can be manufactured from starch by enzymatic hydrolysis. 34Fructose or fruit sugar occurs naturally in fruits, some root vegetables, cane sugar and honey and is the sweetest of the sugars. It is one of the components of sucrose or table sugar. It is used as a high fructose syrup which is manufactured from hydrolized corn starch which has been processed to yield corn syrup, with enzymes then added to convert part of the glucose into fructose. 35Galactose does not generally occur in the free state but is a constituent with glucose of the disaccharide lactose or milk sugar. It is less sweet than glucose. It is a component of the antigens found on the surface of red blood cells that determine blood groups. 36

Disaccharides

Sucrose, maltose and lactose are all compound sugars, disaccharides, with the general formula C12H22O11. They are formed by the combination of two monosaccharide molecules with the exclusion of a molecule of water. Sucrose is found in the stems of sugar cane and roots of sugar beet. It also occurs naturally alongside fructose and glucose in other plants, particularly fruits and some roots such as carrots. The different proportions of sugars found in these foods determines the range of sweetness experienced when eating them. A molecule of sucrose is formed by the combination of a molecule of glucose with a molecule of fructose. After being eaten, sucrose is

split into its constituent parts during digestion by a number of enzymes known as sucrases. 37Maltose is formed during the germination of certain grains, most notably barley which is converted into malt, the source of the sugar's name. A molecule of maltose is formed by the combination of two molecules of glucose. It is less sweet than glucose, fructose or sucrose. It is formed in the body during the digestion of starch by the enzyme amylase and is itself broken down during digestion by the enzyme maltase. 38Lactose is the naturally occurring sugar found in milk. A molecule of lactose is formed by the combination of a molecule of galactose with a molecule of glucose. It is broken down when consumed into its constituent parts by the enzyme lactase during digestion. Children have this enzyme but some adults no longer form it and they are unable to digest lactose. 39

Production of sugarcane

Sugarcane (Saccharum spp.) is a perennial grass in the family Poaceae. It is cultivated in tropical and sub-tropical regions for the sucrose that is found in its stems. It requires a frost-free climate with sufficient rainfall during the growing season to make full use of the plant's great growth potential. The crop is harvested mechanically or by hand, chopped into lengths and conveyed rapidly to the processing plant. Here it is either milled and the juice extracted with water or the sugar is extracted by diffusion. The juice is then clarified with lime and heated to kill enzymes. The resulting thin syrup is concentrated in a series of evaporators after which further water is removed by evaporation in vacuum containers. The resulting supersaturated solution is seeded with sugar crystals and the sugar crystallizes out, is separated from the fluid and dried. Molasses is a by-product of the process

and the fiber from the stems, known as bagasse, is burned to provide energy for the sugar extraction process. The crystals of raw sugar have a sticky brown coating and can either be used as they are or can be bleached by sulphur dioxide or treated in a carbonatation process to produce a whiter product. 40Maharashtra's gross state domestic product for 2011 is estimated at Rs901, 330 crore (US$164. 04 billion) in current prices. As of 2010 Maharashtra had a Per Capita Income of $ 1, 660, far ahead of national average of $ 1, 219 . Maharashtra's GDP Per Capita crossed the US$ 2, 000 threshold for the first time in 2011 making it one of the richest states in India. Maharashtra is third-most urbanised state with urban population of 45% of whole population. Mumbai, the capital of Maharashtra houses the headquarters of almost all major banks, financial institutions, insurance companies and mutual funds. Within Mumbai is located Bollywood, the centre of India's Hindi film and television industry. India's largest stock exchange Bombay Stock Exchange, oldest in Asia, is located in the city. After successes in the information technology in the neighbouring states, Maharashtra has set up software parks in Pune, Mumbai, Navi Mumbai, Nagpur and Nasik, Aurangabad. 41 Now Maharashtra is the second largest exporter of software with annual exports of 18 000 cr and accounts for more than 30 per cent of the country's software exports, with over 1, 200 software units based in the state42[42] Maharashtra ranks first nationwide in coal-based thermal electricity as well as nuclear electricity generation with national market shares of over 13% and 17% respectively. Maharashtra is also introducing Jatropha cultivation and has started a project for the identification of suitable sites for Jatropha plantations4343] Ralegaon Siddhi

is a village in Ahmednagar District that is considered a model of environmental conservation. 44Over 41% of the S&P CNX 500 conglomerates have corporate offices in Maharashtra. Maharashtra is India's leading industrial state contributing 13% of national industrial output. 64. 14% of the people are employed in agriculture and allied activities. Almost 46% of the Sugar industry has made considerable progress specially in the co-operative sector. Maharashtra is well known for the development of sugar industry on co-operative lines in which the farmers acquire a share in the sugar mills. Pharmaceuticals, petrochemicals, heavy chemicals, electronics, automobiles, engineering, food processing, and plastics are some of the major industries of the state. Maharashtra is renowned for the production of three-wheelers, jeeps, commercial vehicles and cars, synthetic fibers, cold rolled products and industrial alcohol. Small scale industries have also come up in a big way in the state. The state capital Mumbai is called as an industrial city. Industrial development in the state is largely concentrated in Mumbai. The six important industries in the district are cotton textiles, chemicals, machinery, electricals, transport and metallurgy These industries also provide employment to a considerable number of people in Mumbai. Although Maharashtra is a highly industrialized state of India, agriculture continues to be the main occupation of the state. Principal crops include rice, jowar, bajra, wheat, pulses, turmeric, onions, cotton, sugarcane and several oil seeds including groundnut, sunflower and soyabean. The state has huge areas, under fruit cultivation of which mangoes, bananas, grapes, and oranges are the main ones. Irrigation facilities are being extended so that agriculture could be made less dependent upon rain water. The net irrigated area totals

33, 500 square kilometres. Sangli of pilgrims (City) is a District headquarter of Sangli District in the state of Maharashtra, India. Although Sangli is distinguished for production and trade of turmeric, it is not called Turmeric city (Erode is Yellow/Turmeric/Textile city. Sangli is situated on the banks of river Krishna and is the largest market place for Turmeric in Asia and houses many sugar factories. The Ganesh Temple of Sangli is a historical landmark of the city and is visited by thousands. The Sugar Industry in India is part of Netscribes' Food & Beverage Series reports. The market will be boosted by the rapidly growing food and beverage industry with increasing production of confectionaries, resulting in increased demand for sugar. The report begins with the market overview section, providing details on the domestic sugar production and consumption. India is the world's largest sugar consuming country and is also the second largest in terms of sugar production. The growth of sugar factories along with the sugar industry segments depicts the sugar industry scenario in India. The sugarcane overview section provides a clear idea about the linkage between the sugarcane farmers and millers, including growth of sugarcane production and cane acreage. This is followed by the sugar industry value chain, illustrating the structure and operational mechanism in the sugar plants and sugar refineries, including the distillery and cogeneration process. The regional distribution section provides a vivid description of the sugar industry in the largest sugar producing states across the country, including Maharashtra, Uttar Pradesh, Karnataka, Tamil Nadu, Andhra Pradesh, Gujarat, Haryana, Punjab and Bihar. This section provides state-wise information, such as no. of sugar factories, sugar production, average sugarcane production, sugarcane area and production. Growing

population coupled with rising income is providing impetus to the growth in the country’s sugar consumption, benefiting the overall sugar industry. India is the world’s second largest populated country, representing about 17. 31% of the global population. Aggressive growth in the food and beverage industries will lead to the increasing demand for sugar. High sugar content in confectionaries, including chocolates, pastries and ice-creams, will drive the domestic demand for sugar. By-products, such as ethanol and power via cogeneration provides cross functional and cross business opportunities. Growing pharmaceutical market and low per capita sugar consumption in India provide opportunities for the players to capitalize upon. The challenges hindering the market are illustrated. Oversupply situation coupled with higher cane prices results in declining profit margin for the players in the sugar industry. Cyclical nature of the crop results in volatility in sugar production leading to high cane arrears. The present pricing policy is highly government regulated resulting in limited bargaining power of the sugar millers. The government initiatives section provides a detailed description about the Pre-Budget Memorandum 2012-13, including removal of 10% levy sugar quota, implementation of tax incentives, Cenvat Credit on Bagasse, tax deduction under section 35 AD and exemption from both service tax and value-added tax. This is followed by the government’s consideration to decontrol the sugar sector. The competition section begins with the Porter’s Five Forces analysis for the sugar market. It outlays the competitive landscape of the sugar market in India briefing about the domestic and foreign players existing in the market. This section provides a three dimensional analysis of domestic key players’ revenues, profits and market

capitalization. The report also features brief profiles of major domestic and foreign players in the market and a snapshot of their corporation, financial performance along with the key financial ratios, business highlights and their product portfolio providing an insight into the existing competitive scenario. Some of the key statistics or factors impacting the sugar market in India covered in the report include growth of sugar production, consumption and no. of factories, sugar industry scenario in 2010-11, growth of sugarcane production and cane acreage, sugar-value chain, no. of factories (state-wise), sugar production (state-wise), Avg. sugarcane production (state-wise), sugarcane area and production (state-wise), major players in each state, export and import (value-wise), growing population, rise in per capita income, growing confectionary, chocolate and ice-cream market, potential alcohol demand, pharmaceutical market growth, annual per capita sugar consumption, state advised cane prices and induced cyclicality. The Sangli region is known as the " Sugar Belt of India". This region houses over thirteen large sugar factories. Vasantdada Patil, who served as chief minister of Maharashtra for four terms, started the co-operative movement which helped Maharashtra become the most developed state in India. Most of the sugar factories of the Sangli sugar belt work on the co-operative basis. Vasantdada Sugar Factory near Sangli city was the largest sugar plant in Asia till late 90s. Sangli District is located in the western part of Maharashtra. It is bounded by Satara and Solapur districts to the north, Bijapur District to the east, Kolhapur and Belgaum districts to the south, and Ratnagiri District to the west. Sangli district is situated in the river basins of the Warna and Krishna rivers. The valley of the River Krishna and its tributaries is one of the

greenest areas of the country. Other small rivers, such as the Warana and the Panchganga, flow into the River Krishna. Land in the region is best suitable for agriculture. The physical settings of Sangli District shows a cossntrast of immense dimensions and reveals a variety of landscapes influenced by relief, climate and vegetation. The climate ranges from the rainiest in the Chandoli (Shirala) region, which has an average annual rainfall of over 4000 mm, to the driest in Atpadi and Jath tehsils where the average annual rainfall is about 500 mm. The vegetal cover too varies from the typical monsoon forest in the western parts to scrub and poor grass in the eastern parts. The Sangli district comes under Deccan plateau geographic region. Sangli city is known as Natyapandhari, the birthplace of Marathi dram. 45 It has a historic Ganpati temple built in the 18th century by ruling Patwardhan dynasty of Sangli, appointed by Peshwas of Pune. Harbhat, son of Balambhat Patwardhan, is regarded as the founder of the city. The city derives its name from " Saha Galli" (" Six Lanes" in Marathi). The India is second largest producer of sugar country in the world. The sugar industry plays an important role in India’s economy. It is the second largest industry in the country, next to textiles and provides direct employment to more than 3. 6 lakh persons. The cultivation and transportation of sugarcane to the sugar mills provides a source of income to large number of farmers, laborers, technicians, transport operators. It also supports a number of engineering industries Molasses, press mud and Bagasse are the three important by-products of the sugar industry. Indian Sugar mills generate a lot of waste water. The BOD of this combines waste water is very high. The pollution standards stipulate that BOD of waste water should be less than 30 mg/l for

disposal into inland surface waters and less than 100 mg/l for disposal on land. BOD can be on a higher side, in case land application of treated waste water is envisaged as a secondary treatment system for The sugar mill waste water, as it leaves the premises, has a relatively clear appearance, however, after stagnating for some time, the waste water turns black and starts emitting foul odor. If discharged in water courses, its high BOD depletes dissolved oxygen in water and makes the environment unfit for fish and other aquatic life. Oil and grease in waste water hasten such mortalities. If untreated waste water is discharged on land, decaying organic solid and oil and grease present in the waste water clog the soil pores. The waste waters from some of the sections contain considerable amount of suspended solids. Air PollutantsMost of the sugar mills use Bagasse as a fuel in boilers. The burning of Bagasse in boilers produces particulate matter, oxides of nitrogen, carbon, sulphur and water vapor. Except for particulate matter, other emissions of Bagasse fired boilers are within the limits prescribed by the pollution control authorities. The particulate matter, usually referred to as fly ash, consists of ash, unburnt Bagasse and carbon particles. Fly ash is very light and it contains a large percentage of fines. If air pollution control equipment is not installed, fly ash will fully escape into the atmosphere through the chimney. The particulate matter coming out of the chimney will travel distances depending on particle size and atmospheric conditions. There is a reduced visibility in the areas surrounding the sugar mill. The heavier particles settle on vegetation and damage them. There are reports of dizziness and physiological effects like irritation in the eye, nose, throat and lungs, in the surrounding areas. Recommendations During the process of

sugar manufacture, condensates are available from juice heaters, multiple effect evaporates, vacuum pans etc. These condensates, if contaminated with juice, have to be disposed off as waste water. Recycling of condensates and cooling water helps in minimizing the amount of water joining the waste water stream. This also helps in conservation of water, which has become a scare resource for several sugar mills. Besides, sugar mills have to take steps to minimize the amount of pollutants joining the waste water stream. The sugar mill waste water contains large quantities of bio-degradable organic matter and therefore biological treatment processes are most commonly used for its treatment. Treated waste water with a BOD level of about 100 mg/l can be used for Multi-cyclones, wet collectors, bag filters and electrostatic precipitators can reduce particulate matter in boiler emissions by 90% or more. These equipments can reduce the concentration of particulate matter to 450 mg/Nm3 or less. A number of sugar mills have already installed waste water treatment plants and air pollution control equipment.

DISTILLERIES:

Existing Molasses -based Distilleries will furnish bank guarantee and Action Plan to concerned State Board to ensure compliance with any combination of the following measures; . Compost making with press mud/agricultural residue/ Municipal Waste: Concentration and drying/ Incineration: Treatment of spentwash through biomethanation followed by two stage secondary treatment and dilution of the treated effluent with process water for irrigation as per norms prescribed by CPCB/MoEF. Treatment of spentwash through bio- machination following by secondary treatment (BOD < 2500

mg/l) for controlled discharge into sea through a proper submerged marine outfall at a point permitted by SPCB/CPCB in consultation with National Institute of Oceanography (NIO), so that Dissolved Oxygen in the mixing zone does not deplete to less than 4. 0 mg/I. For taking decision on feasibility of one time controlled land application of treated effluent, a study will be under taken within three months. The road map for utilization of spentwash by the distilleries to achieve zero discharge of spentwash in inland surface water courses will be as below:-50% utilization of spentwash - By March, 200475% utilization of spentwash - By March, 2005 100% utilization of spentwash - By December, 2005The 100% utilization of spentwash is achieved, controlled and restricted discharge of treated effluent form lined lagoons during rainy season will be allowed by SPCB/CPCB in such a way that the perceptible coloring of river water bodies does not occur. Monitoring Task Force consisting of CPCB, SPCB, Experts and industry shall be constituted for monitoring the implementation of action points.