INTRODUCTION

Soda ash is the trade name for sodium carbonate, a chemical refined from the mineral trona or sodium-carbonate-bearing brines (both referred to as "natural soda ash") or manufactured from one of several chemical processes (referred to as "synthetic soda ash"). Soda ash, which is one of the most important of all chemical products and is a starting material in producing many other chemicals, is produced in the largest amounts compared with other soda products. It is an essential raw material in glass, chemicals, detergents, and other important industrial products. In 1998, in terms of production, soda ash was the 11th largest inorganic chemical of all domestic inorganic and organic chemicals, excluding petrochemical feedstocks. Although soda ash represented only 2% of the total $39 billion U.S. nonfuel mineral industry, its use in many diversified products contributed substantially to the gross domestic product of the United States. Because soda ash is used in flat glass for automobile manufacture and building construction, which are important economic sectors of the domestic economy.

The original Leblanc process for soda ash manufacturing never used in the united states, was abandoned in Europe early in 20^{th} century. The modern method, know as the ammonia-soda or Solvay process, is used to produce most of the world's soda ash. However there has been a very rapid development of natural soda ash processes of refining natural deposits of sodium carbonate compounds. Soda ash produced by the Solvay or other chemical processes is called synthetic ash. The growth of natural soda ash production is particularly striking in the united states and is due to both environmental and cost considerations. It is expected, however, that natural soda ash will make only limited inroads on worldwide production in the near future since the natural deposits are more limited than the raw materials used in the solvay process and, in many cases, are far removed from the consuming industries.

World Resources: Soda ash is obtained from trona and sodium carbonate-rich brines. The world's largest deposit of trona is in the Green River Basin of Wyoming. About 47 billion metric tons of identified soda ash resources could be recovered from the 56 billion tons of bedded trona and the 47 billion tons of inter bedded or intermixed trona and halite that are in beds more than 1.2 meters thick. About 34 billion tons of reserve base soda ash could be obtained from the 36 billion tons of halite-free trona and the 25 billion tons of inter bedded or intermixed trona and halite that are in beds more than 1.8 meters thick. Underground room-and-pillar mining, using a combination of conventional, continuous, and short wall mining equipment is the primary method of mining Wyoming trona ore. The method has an average 45% mining recovery, which is higher than the 30% average mining recovery from solution mining. Improved solution mining techniques, such as horizontal drilling to establish communication between well pairs, could increase this extraction rate and enable companies to develop some of the deeper economic trona. Wyoming trona resources are being depleted at the rate of about 15 million tons per year (8.3 million tons of soda ash). Searles Lake and Owens Lake in California contain an estimated 815 million tons of soda ash reserves. There are at least 62 identified natural sodium carbonate deposits in the world, some of which have been quantified. Although soda ash can be manufactured from salt and limestone, both of which are practically inexhaustible, synthetic soda ash is more costly to produce and generates environmentally deleterious wastes.

History of soda ash industry in India

The first two factories for the production of soda ash were set up in India through the pioneering efforts of the late Shri Kapilram Vakil, the first at Dhrangadhra in 1924, and the other during the years of the Second World War at Mithapur near the extreme western tip of the country. These two units continued as the only producers of soda ash in 1951, with combined capacity and production of 54,000 and 47,000 tones respectively, at that time, domestic production represented about half of the annual consumption in the country. Both units employed the standard Solvay process. But, at Dhrangadhra, Honigman conical carbonators were employed, whereas, at Mithapur, the more popular

tower carbonators were provided. Expansion and modernization of these two factories increased their capacity and production to 90,000 tones a year by the end of the First Plan in 1956. During this period, the Development Wing of the Ministry of Commerce and Industry prepared a Report to determine suitable sites for locating new plants, to ensure low cost production and also to make the country self-sufficient with respect to soda ash by the end of the Second Plan in 1961.

According to the recommendation made in the Report, two new plants were licensed, one at Porbandar employing the standard Solvay process and the other at Tirunelvelly, near the port of Tuticorin in South India, where the promoters proposed that caustic soda, made on a large scale by electrolysis of salt, would be carbonated to produce soda ash. There was some doubt if this project would be implemented as proposed, because the prices current then per tone of caustic soda ash were in the ratio of 2:1, whereas the equivalent weights are in the ratio of 1:1.33. This hunch provision to proceed first with the caustic soda stage only until today, it remains as the largest caustic soda producer in the country with an annual capacity of 54,000 tones per day, was commissioned in 1960 and no makes 400 tones per day. The Mithapur project completed its expansion to 600 tones per day and to increase the capacity further to 750 or 100 tones as may be licensed by Government.

The concentration of all capacity for soda ash the small area of Saurashtra in the extreme Western part of India has always been a cause for concern, thereby the cost of freight to distant areas in the Southern and East becomes high, and even distribution of soda ash is affected during busy transport periods. At the same time, it has been conceded that circumstances favorable for the production of large amounts of by solar evaporation of seawater, and the availability of good quality limestone close by, make Saurashtra attractive location for soda ash projects. In the effort towards regional dispersal of the industry, a 120-tonnes per day plant was licensed during the second plan Varanasi in U.P., based on the modified Solvay process that yields soda ash and ammonium chloride as co-products. The plant was commissioned in 1959. But technical difficulties prevented it from operating at more than half its capacity for many years.

Another license for a 200 tones per day soda ash plant employing the standard Solvay process to be located at Uran. Near Bombay, was issued in 1956. It was proposed that limestone for this plant would be obtained by sea from Saurashtra and the cost of freight on limestone was expected to be compensated for by the availability of soda ash at a large consuming center to Bombay. However, the license was revoked six years later as there was no progress on the scheme. At that time, the modified Solvay process had achieved considerable topical interest because of its rapid application in Japan, consequent on ammonium chloride being proved as an effective nitrogenous fertilizer for the rice crop. Encouraged by its success in Japan, entrepre obtained licenses for setting up 200 per day soda ash cum ammonium chloride plants at Madras, Bombay and in Andhra Pradesh. There is no progress in any of these schemes and the Madras and Andhra licenses have been cancelled by Government. The difficulty seems to be that, in the present era of fertilizer plants of large capacity for nitrogen, ammonium chloride cannot be sold at a profit, if it is made as a by-product in cost, relatively small-scale, plant. As fertilizer factories are reluctant to sell ammonia except at a high profit, and an alternative source of carbon dioxide soda ash plant is adjacent to a fertilizer factory, purchase of ammonia is out of the question. Therefore it is doubtful if the hopes centered on the application of the modified Solvay process will be fulfilled. In the meanwhile, a license for establishing, at Porbandar, a second soda ash plant with capacity of 400 tones per day, employing the standard Solvay process, has been granted.

The total capacity production of the four existing soda ash plants during 1969 were 430,000 and 390,000 tones, respectively, and the corresponding targets for 1973-74 were 650,000 and 550,000 tones. The country was virtually self-sufficient with respect to light ash by 1961. Special efforts were necessary to achieve a similar position with heavy ash. The difficulty was that the class industry in India had become accustomed to the use of natural heavy soda, that used to be imported from Magadi in East Africa. Heavy ash from Magadi was cheaper than even synthetic light ash made in the country and, therefore, there was no incentive for the domestic manufacture to convert light into heavy ash. It was also not easy to decide whether the preference for heavy ash by the Glass

Industry was dependent on quality or price. The problem was resolved by canalizing the import of heavy ash through the State Trading Corporation, equalizing its release price with that of synthetic light ash to begin with, and later by selling heavy ash at a price thirty rupees higher per tone than that of light ash. The arrangement provided the necessary incentive for indigenous production of heavy ash as well as restricted its use for purposes where such use was essential, irrespective of price. Self-sufficiency that has been attained for both varieties of soda ash can be maintained in the next decade, if additional capacity to the extent of about 40,000 tones is added each year. A considerable proportion of the equipment for a soda ash plant is made in the country and it is claimed that, for expansion of capacity, foreign exchange expenditure can be reduced to 20 per cent of the total cost of the project. The industry has the potential not only for export of soda ash but also for establishing soda ash plants in other developing countries as joint ventures.