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PRODUCING MGO FROM SEA WATER, A DESIGN STUDY FOR A PLANT USING ARABIC GULF SEA WATER MIXED WITH CALCINED DOLOMITE

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ABSTRACT
This study will cover the main principle design of the prototype plant to produce MgO with concentration of 95% and capacity of 5.0 Ton/day using both sea water and calcined dolomite, including proposed technical description of main equipment's.

The most convent way to produce Mgo from Arabian Gulf water is by using both Gulf sea water with dolomite which is considered the most economical, the rezone's are:-

A- Availability of dolomite with huge quantities and high purity, especially in Muthana governess in south of Iraq.

B- Easy in process.

C- Sea water is considered a big natural resource for Mg with concentration of about 2-3 gm/l

Keywords: Sea water, Calcined dolomite, Arabian Gulf, MgO.

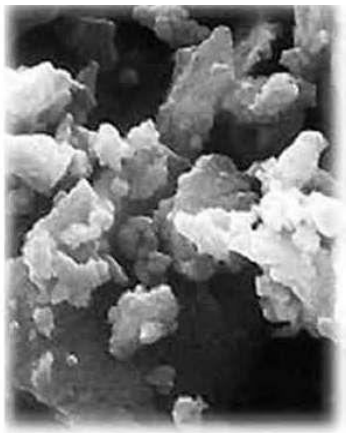
Chapter -1 (Introduction)

1-1 - Dolomite material [$CaMg(CO_3)_2$]

Magnesium was derived from the name "Magnesia", discovered from the magnesium compounds in a region in Asia Minor In 1965,

1-2 - Existence

Magnesium exist as a common element in the rocks of the earth's crust, it will be about 2.3% by weight,



10,000 X (surface area: <0.1m^2 /gr)

Magnesium ions in the form of magnesium hydroxide.

1-3 - Preparation of Magnesium:

Magnesium is prepared in a number of ways, this include:

1. Mines: The extraction of magnesium chloride salts from the Mines composing of 3% magnesium, 9% magnesium chloride, 14% sodium chloride, and (0.1%) bromide ion.

2. Sea water: sea water is processed to extract ($MgCl_2.1.5H_2O$) been treated chemically using CaO.

3. Althail Supply: This is a process use in extracting magnesium from dissolve magnesium oxide mixture of fusion (Fused) fluorides of magnesium, barium, sodium. The electrolysis process of firing magnesium on the cathode and oxygen on the elevator.

It is also known as magnesium preparation by resampling okSidh with carbon under high temperature. Where magnesium mounts in vapor with carbon monoxide, and therefore must be cooled to avoid these gases occurring in an inverse reaction.

1-4- Magnesium Compounds

Magnesium usually don't exist as an individual element but as compounds spread across the world. There are vehicles sulfate, magnesium chloride in abundance in the land and water, for ease of solubility in water, magnesium widespread and they are in the form of metal Mganzat $MgCO_3$ which is not soluble in water, as well as the compound dolomite $MgCO_3.CaCO_3$ $MgCO_3.CaCO_3$ as magnesium resides with other compounds such as asbestos $H_4Mg_3Si_2O_9$, and Merckom $Mg_2Si_3O_3.2H_2O$, and the open hydrated or steatite $Mg_3Si4O10\ (OH)_2$, and Brosaat $Mg\ (OH)_2$.

Human metals magnesium salts have been known since ancient times and used in multiple purposes, before the discovery of magnesium thousands of years later.

The most important compounds in common use since ancient civilizations:

1-4-1 - Stone Soap.

Stone soap is a less solid metallic material with a hardness 1, tender and soft in texture and can easily be scratched with the nails, with a pearly luster and greasy when felt, having a density of $2.8g/cm^3$, multi color white, blue, gray, green, red varieties. When crushed, it is usually white suggesting that its color can be used as its physical and crystalline classification with relation to the amount of impurities.

When it is compacted and composing of mineral impurities, it is called a stone soap.

In this study, the outcropping rock is a sedimentary dolomitic limestone of Precambrian age (over 600 million years old). Containing a small amount of mineral impurities such as Tremolite, Aktinolat, and Chlorite (a green metal) appearing more in the outcropping rock. When this rock is subjected to hot aqueous solutions emanating from the ground, it produces Serpentine rocks, which is economically exploitable. Serpentine deposits are commonly found in Egypt, Canada, Australia and in the United States of America.Before being put into use for medical purposes , as industrial powder (talc), and for cosmetic uses, it is first processed to eliminate its toxic substances, such as Arsenic, Cadmium, Selenium, and reduce other elements proportion to 10 grams per ton.

1-4-2- Asbestos

Asbestos is the name given to a group of fibrous, naturally occurring silicate minerals. They generally exist in nature in metamorphic or altered basic and ultrabasic igneous rocks. While the name "asbestos" goes back to ancient times

1-4-3 - Peridot.

Olivine is a silicate mineral with the formula of (Mg, Fe) $2SiO_4$. As peridot is the magnesium-

1-4-4 - Almjnezi

Almjnezi is magnesium carbonate, a white substance Ktlah medium hardness and density of about 3.2 g / cm 3

1-5 - Dolomite,

Which is named after the French mineralogist Deodat de Dolomieu , is a common sedimentary rock-forming mineral that can be found in massive beds several hundred feet thick.

Physical Characteristics of Dolomite:

Photo for hard burned magnesinm oxide

- Color is often pink or pinkish and can be colorless, white, yellow, gray or even brown or black when iron is present in the crystal.
- Luster is pearly to vitreous to dull.
- Transparency crystals are transparent to translucent.
- Crystal System is trigonal; bar 3
- Crystal Habits include saddle shaped rhombohedral twins and simple rhombs some with slightly curved faces, also prismatic, massive, granular and rock forming. Never found in scalenohedrons.

Photo for dead Burned magnesium oxide

- Cleavage is perfect in three directions forming rhombohedrons.
- Fracture is conchoidal.
- Hardness is 3.5-4
- Specific Gravity is 2.86 (average)
- Streak is white.
- Other Characteristics: Unlike calcite, effervesces weakly with warm acid or when first powdered with cold HCl.
- Associated Minerals: include calcite, sulfide ore minerals, fluorite, barite, quartz and occasionally with gold.
- Notable Occurrences include many localities throughout the world, but well known from sites in Midwestern quarries of the USA; Ontario, Canada; Switzerland; Pamplona, Spain and in Mexico.
- Best Field Indicators are typical pink color, crystal habit, hardness, slow reaction to acid, density and luster

1-5-2 - Magnesium oxide (MgO), or magnesia,
Is a white hygroscopic solid mineral that occurs naturally as periclase and is a source of magnesium (see also oxide

Magnesium oxide was historically known as magnesia Alba (literally, the white mineral from Magnesia - other sources give magnesia alba as MgCO3), to differentiate it from magnesia negra, a black mineral containing what is now known as manganese.

1-6 – MgO Production
Magnesium oxide is produced by the calcination of magnesium carbonate or magnesium hydroxide or by the treatment of magnesium chloride with lime followed by heat.

, the bright flame is very hard to extinguish and it emits a harmful intensity of UV light. Inhalation of magnesium oxide fumes can cause metal fume fever.[19]

1-7 – Applications
A refractory material is one that is physically and chemically stable at high temperatures. "By far the largest consumer of magnesia worldwide is the refractory industry, which consumed about 56% of the magnesia in the United States in 2004, the remaining 44% being used in agricultural, chemical, construction, environmental, and other industrial applications."[5]

1-7-1 - Cement
MgO is one of the raw materials for making Portland cement in dry process plants. If too much MgO is added, the cement may become expansive.[clarification needed] Production of MgO-based cement using serpentinite and waste Carbon dioxide (CO_2) (as opposed to conventional CaO-based cement using fossil fuels) may reduce anthropogenic emissions of CO_2.[6]

1-7-2 - Desiccant
MgO is a relatively poor desiccant, but because it neutralizes sulfur oxide acids created by oxidation of Kraft-processed papers, it is used by many libraries for preserving books.[7]

1-7-3 - Medical
In medicine, magnesium oxide is used for relief of heartburn and sore stomach, as an antacid, magnesium supplement, and as a short-term laxative. It is also used to improve symptoms of indigestion. Side effects of magnesium oxide may include nausea and cramping.[8] In quantities sufficient to obtain a laxative effect, side effects of long-term use include enteroliths resulting in bowel obstruction.[9]

1-7-4 - Other
- MgO is used as an insulator in industrial cables, as a basic refractory material for crucibles and as a principal fireproofing ingredient in construction materials. As a construction material, magnesium oxide wallboards have several attractive characteristics: fire resistance, moisture resistance, mold and mildew resistance, and strength.
- It is used as a reference white color in colorimetry, owing to its good diffusing and reflectivity properties.[10] It may be smoked onto the surface of an opaque material to form an integrating sphere.
- It is used extensively in heating as a component of tubular construction heating elements. There are several mesh sizes available and most commonly used ones are 40 and 80 mesh per the American Foundry Society. The extensive use is due to its high dielectric strength and average thermal conductivity. MgO is usually crushed and compacted with minimal airgaps or voids. The electrical heating industry also experimented with aluminium oxide, but it is not used anymore.
- MgO doping has been shown to effectively inhibit grain growth in ceramics and improve their fracture toughness by transforming the mechanism of crack growth at nanoscale.[11]

- Pressed MgO is used as an optical material. It is transparent from 0.3 to 7 µm. The refractive index is 1.72 at 1 µm and the Abbe number is 53.58. It is sometimes known by the Eastman Kodak trademarked name **Irtran-5**, although this designation is obsolete. Crystalline pure MgO is available commercially and has a small use in infrared optics.[12]
- MgO is packed around transuranic waste at the Waste Isolation Pilot Plant, to control the solubility of radionuclides.[13]
- An aerosolized solution of MgO is used in library science and collections management for the deacidification of at-risk paper items. In this process, the alkalinity of MgO (and similar compounds) neutralizes the relatively high acidity characteristic of low-quality paper, thus slowing the rate of deterioration.[14]
- MgO is also used as a protective coating in plasma displays.
- Magnesium oxide is used as an oxide barrier in spin-tunneling devices. Owing to the crystalline structure of its thin films, which can be deposited by magnetron sputtering, for example, it shows characteristics superior to those of the commonly used amorphous Al_2O_3. In particular, spin polarization of about 85% has been achieved with MgO[15] versus 40–60% with alluminium oxide.[16] The value of tunnel magnetoresistance is also significantly higher for MgO (600% at room temperature and 1100% at 4.2 K[17]) than Al_2O_3 (ca. 70% at room temperature[18]). MgO is thermally stable up to about 700 K, vs. 600 K for Al_2O_3.

1-8 - Benefit of magnesium for the body.

Magnesium is essential for the work of many vital functions, including the balance of the member visceral content of calcium, and is working on the transfer of phosphate from one part to another part of the body, helping to get rid of excess phosphoric acid from the body.

It is essential to the work of many of the enzymes responsible for metabolism Alvhamaiaat.

1-8-1 - The body's need of magnesium..

Children need magnesium to grow properly, daily requirement is measured per kilogram of body weight (300-350mg per day).

2 - HOW TO PRODUCE MGO

2-1 - Electrochemical analysis

This method is sometimes called the name of the process (de) (Dew process) This was the first method used for the production of magnesium in commercial quantities, and the basis of this process is the same basic method use in extracting aluminum. Magnesium oxide is a compound of a metal with a non-metal, so – as you would expect – it is held together with ionic bonds. It has the same structure as NaCl but because it is made of Mg^{2+} and O^{2}– ions, rather than the singly charged Na^{+} and Cl^{-} ions, there is a much stronger attraction between the ions. This means it takes a lot more energy to pull them apart, so MgO has a melting point of 3125K, nearly three times the melting point of 1074K for sodium chloride. This strong attraction between the ions is also responsible for magnesium oxide being much less soluble than sodium chloride. The process of extraction of Magnesium begins by mixing the seawater with its suspended salts, including magnesium hydroxide ($Mg(OH)_2$), with calcium oxide (CaO), also called 'lime', to make a slurry. The slurry is permitted to rest for the solids to settle down at the bottom and the water rises to the top. Then, the solids are removed, filtered, and washed to remove residual chlorides. The end result is a loosely packed "cake" of material which is calcined in a kiln (a type of high temperature oven) to leave magnesium behind. Calcination is a thermal treatment process applied to ores and other solid materials in order to bring about a thermal decomposition, phase transition, or removal of a volatile fraction. Depending on the exact compound required, other ingredients such as sulfuric acid may be mixed with the slurry to generate a different end product. Since a variety of magnesium compounds are used in industrial processes, these exclusive treatments can create a range of targeted products. The substance may also be turned back into magnesium

hydroxide in the case of milk of magnesia, a solution of magnesium in water, which is used to treat an assortment of intestinal complaints.

$MgCl_2 + Ca(OH)_2$ ------> $Mg(OH)_2 + CaCl_2$

$MgSO_4 + Ca(OH)_2$ -------> $Mg(OH)_2 + CaSO_4$

Then filtered solution containing in this case about 17% magnesium hydroxide, to be offset by the addition of 10% hydrochloric acid, and then we get to the magnesium chloride solution

$Mg(OH)_2 + 2HCl + 4H_2O$ -------> $MgCl_2.6H_2O$

And up magnesium chloride concentration ratio (36%) in the resulting solution, after drying the reaction product rises magnesium chloride concentration ratio of the amount (76%) and the percentage of water in output is about (20%), and transmits the output then to electrolytic cell that operates in a continuous way .

And the passage of direct electric current in the cell decomposes magnesium chloride ions to both chlorine and magnesium, since magnesium density is less than the density of the electrolyte, the magnesium floats on the surface in the cathode region, to then be collected, with a degree of purity of the metal output from this method is approximately (99.8%) , then the chlorine rising at the anode are collected, where it can be re-use to turn the magnesium oxide to magnesium chloride, or it is used in the production of hydrochloric acid.

4- Arabian Gulf

This is the water arm of the Arabian Sea stretching from the Gulf of Oman to the south until the Shatt al-Arab north, 965 kilometers long. [36] The Persian Gulf area of about 233,100 kilometers [36], and varies in width between a maximum of about 370 km [36] to the extent minimum 55 km in the Strait of Hormuz. And the Arabian Gulf does not exceed a shallow depth of only 90 meters in some places. [36]

Bounded on the north and east, Iran; while bordered to the south and southeast of the Sultanate of Oman and the United Arab Emirates, and is bordered to the south-west and west of Saudi Arabia, Qatar, located both Kuwait and Iraq on a limb North Western, while Bahrain is located in the western Gulf

The length of the Arabian coast of the Persian Gulf 3490 kilometer, is the longest of the coast of Iran, since Iran has a 2440-kilometer beach on the Arabian Gulf, so the the Arabian coast is about 1050 kilometers from the Iranian coast.

4-1 - Background Information

Location: South West Asia

The primary source: the Arabian Sea

Littoral states: Iran, Saudi Arabia, Iraq, United Arab Emirates, Kuwait, Oman, Bahrain, and Qatar.

Maximum length: 965 km

Maximum width: 370 km

Area: 233.100

Average Depth: 50 meters

Maximum depth of 90 meters

Map Atlas published in 1634 in the small mapping Mercator and Hondius the Gulf shows it was written in Latin, the name «sinus arabicus» any Arabian Gulf Launches renamed the Arabian Gulf in all Arab countries and Arab organizations, using the United Nations in the minutes of conferences and correspondence in Arabic, Persian Gulf name [37] [38]. While the so-called in Iran (in Persian: Persian Gulf) relative to the Persia older name for Iran, Turkey and accepted by the Ottoman Empire called the Basra Gulf name, and use the rest of the world, citing Western sources naming the Persian Gulf, which is sometimes mixed with Arabian Gulf designation [39] [40].

4-2 - Date

The form of the Persian Gulf in addition to the Red Sea, the basic trade between East and West, waterways and a lot of commercial traffic and cultural exchanges among civilizations in the Greater Middle such as India and China. The civilization of Mesopotamia, has made in the far north-west of the Arabian Gulf. The Gulf region crossroads of civilizations and cultures, ancient, historically because it was located at full Fertile Crescent, a green land that extends from the Gulf region, the far-northern semi-circle problem until northwestern region stretching to the Nile Delta. In the UAE, Oman, found traces of the existence of population settlements dating back to seven thousand years. In these settlements have been discovered distinct pieces of black pottery of the servants of the area (material) to Iraq, Mmaidl that trade across different areas of the Gulf have been active.

4-3 - Ancient and medieval history

Dealer sons of Mesopotamia and their neighbors from different cultures across the Arabian Gulf, Indian Ocean and the Arabian Sea since ancient times, and in spite of the abundance of agricultural products in Mesopotamia remained need to get a metal, wood and stones, they went their boats across the river to reach the waters of the Gulf in search of these resources through trade more profitable. I have said and written historical documents

dating back to the Sumerians three thousand years BC. They were praying for the Megane region (Oman) to bring copper in the southeast of the Arabian Peninsula for two thousand years BC. After civilization Megan responded Delmon name in Bahrain in historical records as a trade center between Mesopotamia and Megan and salinity; (the name launched Akkadian the Indus Valley area), and found there on effects include seals indicate the area that received such goods.

The arrival of the sons of Mesopotamia boats equipped with navigation to the Indus Valley, and it was the Sumerians making their boats from the cane (the jungle). The sailors Megan were also in control of the trade between Mesopotamia and India across the bay in the third century BC. As well as the people of Dilmun on the Gulf Coast near the coast and cities and shot a mother Dalma on the coast of Abu Dhabi and Failaka in Kuwait. It is easy to trade incision through the year 3500 BC. It stretches from the northern Gulf of linking the Mediterranean Sea. Commercial goods that were traded the old Gulf, such as herbs, spices, frankincense, myrrh, textiles, gems and precious stones, ceramics, teak, rice and metals such as copper, which was brought from Megan.

He knew the Gulf as a key source for the pearl trade, Few deep waters of the Gulf enabled divers to reach the depth of the sea to extract the oyster since long Azman. In the sixth century BC. Alokhmonaon established an empire that stretched in full swing to all parts of the Near East, from the Indus Valley to Libya, and as far north as the limits of the ancient kingdom of Macedonia. They were able to control all leading to the Mediterranean trade routes over land and sea; and the kings rebuild the road from the licorice region in Iran to Asardiz near Ephesus and Smyrna. It was to the Roman occupation of Egypt a major impact in preventing Arabs from labor brokers trading, where the Romans dominated the trade routes through the Red Sea and were knowledgeable and highly efficient in sailing skills. Also they took control of the sea road to India.

It probably was built in the same way centuries ago. It has been found on an old necklace in Tel cabled in Umm Al Quwain in the UAE dating back to 300 BC and shows them a clear graphic represents a boat square background and introduction Mtqosh sharp and it sail, it is clear that this sail is identical to a large extent the Arab reef, offers this necklace Description oldest reef triangle, which is called the Latin sail.

With the advent of Islam in the seventh century, it features the Arabian Gulf have changed as well as the neighboring region dramatically, and the beginning of this era has become an Islamic state controlled the trade routes across the Arabian Gulf and the Red Sea, and on the road across Anatolia. In the mid-eighth century, the Islamic State of Albirinh Mountains in the Iberian Peninsula widened up to the Indus River, and during the seven hundred years after the spread of Islam in the west, east and became the Indian Ocean Islamic lake, and I've Arab merchants dominated the trade and goods coming from the east,

4-4 - NEW HISTORY

4-4-1 - Portuguese influence

The Portuguese to reach India after the discovery of the Cape of Good Hope and soon established their empire in the East. In 1507 enables Portuguese fleet led by Afonso de Albuquerque of the occupation of Muscat, Sohar and Khor Fakkan then Hormuz, which occurred king of loyalty to the crown of Portugal's agreement, in 1521 Bahrain fell to the Portuguese.

Ottoman Empire were not have reached the Persian Gulf at the time, but it is after the takeover of Baghdad in 1534 expanded to the south and then went to war with the Portuguese was sent to the Ottoman naval fleet led by Admiral Perry Bey, the commander of the Ottoman fleet in the Suez boxed City Duo in India in 1538 in response to Portuguese campaigns in the Red Sea, the Ottoman campaign failed capita Portuguese attacking Suez.

In 1550 annexation of the Ottomans Qatif, which was from the governor of Hormuz taxable Portuguese property Portugal Fjhzat campaign to expel the Ottomans from Qatif and were able to expel the Ottoman garrison and seize the city, responded Ottomans sent a naval expedition to the Gulf Arab landed in Muscat where seized and expelled its garrison Portuguese then attacked the island of Qeshm .[40]

In August 25, 1553 clashed commander of the Ottoman fleet in the Persian Gulf with the Portuguese fleet, near the birthplace of the Portuguese families of six ships Ottoman withdrew with the rest of the fleet. In 1859 the Ottomans equipped fleet of 72 vessels by 1200 Turkish Onkhari to attack Bahrain's campaign was able to go down to Bahrain and besiege the castle, but the Portuguese reinforcements had arrived and was able to lift the siege and force the Ottomans to withdraw.

Safavid state allied with the British to expel the Portuguese from Hormuz and after the attack on the English Safavid Hormuz eventually surrendered the garrison on 23 April 1622. Portuguese has gone to Muscat. It is hometown to launch the Portuguese raids on Iranian ships and the inconvenience garrison of Hormuz. In 1625 the Portuguese held a reconciliation with the Shah Abbas I. In 1834 the British held a truce with the Portuguese and then held a peace agreement in 1836.

In 1643 to expel the Portuguese from the Imam of Oman Sohar and had brought them out earlier from Ras Al Khaimah. And then he took over Muscat in January 1650 after the Portuguese garrison surrendered.

4-5 - Geographic

Featuring the western shores of the Arabian Gulf being the plain areas with the exception of the Qatar Peninsula base area and the far south of the Strait of Hormuz, where he formed the Musandam peninsula, most of the Arab beach and consists of sandy beaches, with many small coastal islands that includes some internal lakes.

While the east coast is different in the mountainous its composition, with a heavy presence of the slopes; in the case of a beach is very narrow, but does not pose a senior coastal rip in the case of presence and grow up a little bit when encountered small estuaries of the Arabian Gulf's borders. The coastal plain is expanding northward in Bushehr within Iran, to combine them with the delta plains of the rivers Tigris and the Euphrates River and vast Qarun.

The waters of the Arabian Gulf are relatively deep, with a maximum depth of 360 feet where. Femiaha Ajrif to the Wave, and in spite of the high temperature and high humidity in its climate, rarely Maitard storms or air eddies, and therefore it provides a convenient environment for freedom of maritime navigation.

Arabian Gulf waters shallow, rarely Mataatjaoz depth of 90 meters (about 300 feet), could reach in a very few areas to depths greater than 110 meters (360 feet) at the entrance and in isolated places in the southeastern part. Arabian Gulf asymmetric significantly, both in terms of form and in terms of depth, where the deeper water is located along the coast of Iran and most of its regions, with a depth of approximately 35 m (120 ft), there are many Islands with a mostly salt dome and accumulations of coral and debris structures bony minute marine animals.

4-6 - Carrots

• Detailed article: List islands in the Arabian Gulf

Includes the Persian Gulf more than 130 largest Iranian island of Qeshm island endemic Arab Iran and then Kuwait's Bubiyan Island with an area of 863 km 2, and then followed by Bahrain and the island of 620 km2.

4-7 - Resources

Arabian Gulf represents an important resource for coastal cities on its banks, where it was mined for pearls and exported to India and in return for sea trade of goods, in addition to fisheries that is presently affected by the activities of oil and gas fields shared by the littoral states with the exception of Iraq.

4-8 - climate

Arabian Gulf climate uncomfortable, Warmer temperatures are high, although the winters can be very cold in the far northwest of the limbs. Relatively rare heavy rainfall occurs heavy showers between November and April and is denser as we head north, high humidity, a few clouds appear in the winter and is rare in the summer.

Thunderstorms rare and fog, but dust storms (Tuz) talked a lot in the summer, the wind blowing mostly from the north and northwest during the summer, and rarely Matkon strong and rarest get storms in the summer, storms and torrential heavy rains are common in the fall, and the wind speed at the time may sometimes up to 150 km (95 m) per hour in less than 5 minutes. Strong heating and high land adjacent to the coast of heat leads to righteousness and the sea breeze is very strong in the morning and later in the afternoon and evening.[36]

4-9 - MARINE LIFE

4-9-1 - Chemical analysis

Arabian Gulf with most flat Aatlqy only minor deposits from rivers on the east side while pumping in the segment north-west of enormous amounts of silt from the rivers Tigris and Euphrates River Caron, up the flow of these river peaks in the spring and early summer, when the snow melts in the mountains; a product disasters sometimes a flood in the Shatt al-Arab area.

There are some streams and rivers on the Iranian coast south of Bushehr, but in contrast to does not exist any fresh water flows from the hand of the Arabian Peninsula, which in turn extends the Gulf huge quantities of dust, sand (quartz), due to the North-west prevailing winds in the desert surrounding areas.

Many biological processes, biochemistry, and chemical lead to the production of a large amount of calcium carbonate in the form of the wreckage of a structural skeleton and a fine slurry (flour clay), which in turn mixes with sediments that come from the mainland. The deeper areas adjacent to the bottom of the Iranian coast and the area around the delta of the Tigris and Euphrates rivers lined ventricle gray green very rich in calcium carbonate. While the bottom in shallow areas to the south-west is covered with sand color is white or gray and a fine clay carbonates. Petrology bottom in many areas due to the deposition of calcium carbonate next with warm salt water, most of these deposits are a major factor in the composition of coastal islands.

4-9-2 - Salinity

Salinity is rising in the Gulf due to lack of fresh water flowing to him most of which are from the rivers Tigris and Euphrates rivers and Caron addition to the lack of rainfall and high evaporation rates as a result of global temperatures, where the degree of surface water temperature is between 24 to 32 degrees Celsius (75 to 90 Fahrenheit) in the Strait of Hormuz, while up to the extent of between 16 to 32 degrees Celsius (60 to 90 Fahrenheit) in the far north-west, high temperatures this low fresh water flow leads to increased evaporation rate of water;-when salinization rates are high, ranging from 37 to 38ppt at the entrance to the Gulf to an estimated 38 to 41 parts per thousand in the far north-west. Higher rates of heat and the salinization of the largest largest can be observed in the internal bays area on the Arab shore.

4-9-3 - Sea traffic

Tidal rate varies to about 1.2 to 1.5 meters (4 to 5 feet) in the surrounding semi-Qatar Island region and the rate rises to 3.0 to 3.4 meters (10 to 11 feet) to the northwest and to 2.7 to 3.0 meters (9 to 10 feet) in the far south-east. When the wind is strong on the beach, especially in the southern Gulf, can the level of coastal waters to rise by up to 2.4 meters (8 feet), Mmaazbb in a wide flood into low marshes. Strong tidal currents and islands at the entrance to the Gulf, at speeds of up to 8 km (5 miles) / hour. With the exception of areas between the islands or in estuaries and inlets lagoons, rarely exceeding 3 kilometers per hour (one to two miles / hour). At times the wind Mmaaada local currents may affect the reverse.

Maetjaoz rarely high wave three meters (10 feet) at the latest rise in the southern Gulf. The general level rise due to the Indian Ocean does not appear only in the water at the entrance to the Gulf; when a conflict occurs with the direction of the wind and the resulting disorders and watermark Domat.

The general water movement pattern in the Gulf is a movement counterclockwise and is characterized by a vertical natural movement, The water surface, and when entering the Indian Ocean, are subject to evaporation, and thus become more dense and sink into the Gulf body to come out, when she returns from the circulation in the

Gulf, the Strait of Hormuz to Indian Ocean Kttiarat deep water on the bottom surface water streams that enter the Gulf's body.

4-10 - POLLUTION

4-10-1 - Oil pollution

After the first and second Gulf wars, the Arabian Gulf has become especially territorial waters of the Kuwait ecological disaster zone, the region in general, suffers from a serious deterioration in air quality, marine resources, and soil. During the war, poured huge lakes of oil within the sands of the desert, and millions of liters of oil flowed into the Gulf, this article that threatens both the onshore and offshore areas of life and fisheries. Oil wells, which ignited the fire led to making a cloud of soot that covered most of the area, resulting in environmental damage may not be repaired.

The largest amount of oil spilled was a result of the war. During the second Gulf War in 1991, Iraqi forces destroyed eight oil tankers as many oil plants were destroyed on the beach in Kuwait. It has been pouring more than 910 million liters (240 million gallons) in the Gulf (and it is a record for the region). In general sank about 80 vessels to the bottom of the Gulf during the Gulf War, these ships carried a lot of oil and ammunition. The oil slick's worst effects appear when they reach the coastline.

Oil on the coastal area of water kills life that lives within the tide islands region and harm birds and marine mammals by causing discredit the feathers and fur reluctance natural and isolate the water, leading to the sinking of the animals because of the weight of the water, which was carried feathers or die because of the cold due to lower their body heat because of access to water, surpassing the fur or feathers of the skin. In addition, these animals can get sick or poisoned when they eat up oil which cleans the feathers of oil.

4-11 - Temperature fluctuation

Slight changes in water temperatures heat can drive fish and other species that lived within the area to leave, and attract other types. Thermal pollution can accelerate the biological processes in plants, animals and Beltala is drained oxygen levels in the water and therefore the death of life within the region due to lack of oxygen. In 1999,

4-10-2 - Water Pollution

He presented research at the University of Bradford, an opportunity for Iran's claim of approximately US $ 130 million Gulf instead of damage that occurred in 1991 to fisheries and fisheries and marine life to them. [6] As the geography and environmental science department at the university conducted tests on more than 240 samples of oil and sediments and marine life, and was matching crude oil from Kuwait with oil residues in fish and other marine life.[36,37,40]

Chapter -2 (Production of MGO from Arabic Gulf Sea Water

This study will cover the main principle design of the prototype plant to produce MgO with concentration of 95% and a capacity of 5.0 Ton/day using both sea water and calcined dolomite, including proposed technical description of main equipment's.[26]

The most convenient way to produce MgO from Arabian Gulf water is by using both Gulf sea water with dolomite which is considered the most cheaply, the rezone's are:-

D- Availability of dolomite with huge quantities and high purity, especially in muthana governess in south of Iraq.

E- Easy in process.

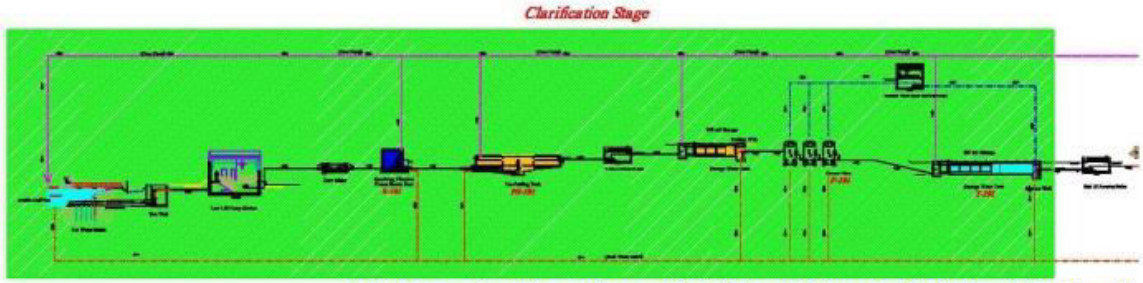
F- Sea water considered a big natural resource for Mg with concentration of about 2-3 gm/l .

5-1 - Proposed plant Technology

The plant can be divided to stages:-

1st – RemoveRemoving of floating materials. Using self-cleaning screen with steel bars.

2nd **-** All sands, muds and deposits in the sea water should be removed using pre- settling and filtration,



MgO production , from Gulf Sea Water & Calcined Dolomite
Hydraulic profile for preparing Mg(OH)2 Stages

3rd -Change sodium bicarbonate soluble in sea water to calcium carbonates.

4th -Sea water will then be stored in earth tanks to ensure a continuous flow of water to the plant.

5th -Dolomite used in this stage will be transferred to one of the cement factory's to be crushed and grind then calcined to a temp. Of 1400 centigrade then grind again and sieved, then moved to the proto-type location by tracks , and fill the vertical steel storage tanks , the calcined dolomite will be moved via conveyer belts to the top of the tanks .and then from the bottoms it will be moved to balance, then to the

reactor in order to be mixed with part of sea water .

$MgO+CaO +2H_2O \rightarrow Ca(OH)_2 + Mg(OH)_2$ ….(1)

Then the mix will be moved to treating devise to ensure the removal of all sea water from all soluble sodium bicarbonate by setting it in the form of -21`0

$Ca(Hco3) + Ca(OH)2 \rightarrow 2CaCO3 + 2H20$ ….(2)

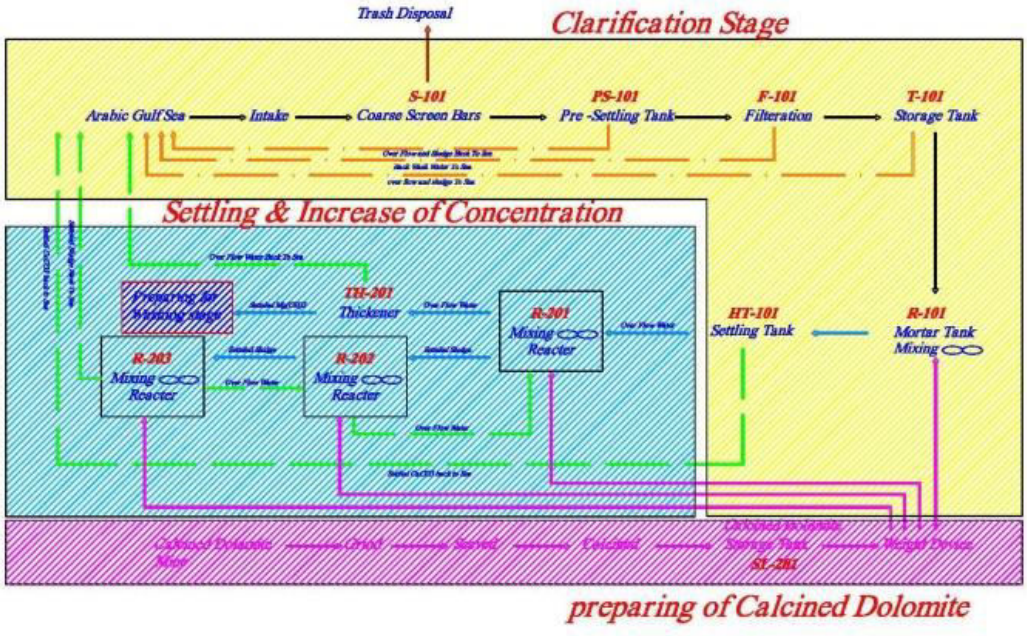
Adding calcined dolomite will affect magnesium salts (MgSO4 ,MgCL2) soluble existed in sea water to be reacted with dolomite which will cause some lost in soluble MgO with about 10% in the form of $Mg(OH)_2$, according to the reaction form below

$Ca(OH)2 + Mg(OH)2 +MgCl2 \rightarrow 2Mg(OH)2 +CaCl2$ ….(3)

$Ca(OH)2 + Mg(OH)2 +MgSO4+ H2O \rightarrow 2Mg(OH)2 +CaSO4.2H2O$ ….(4)

Settled salts will be drown Via pump and discharged back to the Sea.

The overflow will be moved to Mg settling tank reactors.



6th -Magnesium will be settled and separated from sea water and then increase its concentration, a reactor R1 should be installed to mix the calcined dolomite and overflow sea water from stage 5,according to reaction formula no. 3&4 mixing will be done either mechanically by puddles or using jets of water.

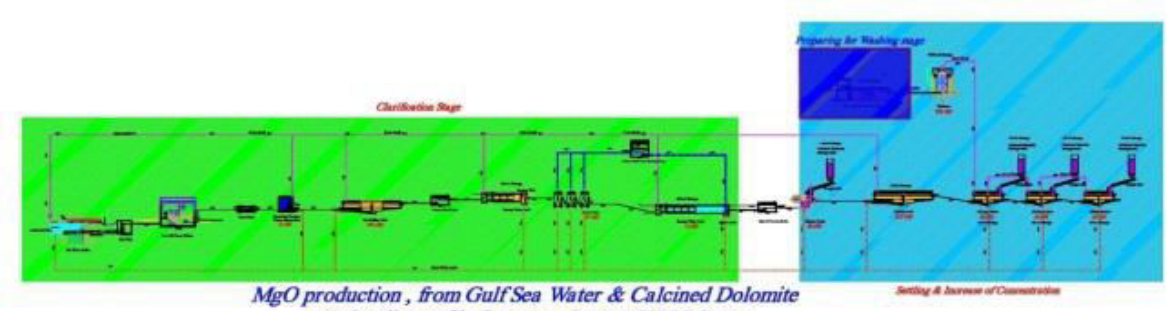
The reacted calcined dolomite should be drowned to another reactor R2, while the formed $Mg(OH)_2$ dissolved will overflow to the thickener , in R2 the chemical reaction of sea water and calcined dolomite will be continued, and the overflow that contained $Mg(OH)_2$ will be pumped again to Reactor R1.

The settled water will also contain the reacted dolomite together with other unsalable alumina, silica, and steel oxide, this set of reactors will ensure efficiency of extraction of magnesia up to 84% , in R1 the concentration of $Mg(OH)_2$ in sea water will be increased to 25% , the overflow will be back to sea , and the settled will be moved to washing stage.

7th - Settled $Mg(OH)_2$ will be washed using very low salinity sea water in two stages , the NaCl will be reduced in sea water that came together with $Mg(OH)_2$ from 27,000 ppm to 5,000 ppm on two stages using back flow .

This stage started with settling sea water by settling tanks, then the overflow water will be pumped to coarse screen and then to pressure filters,$CAHCO_3$ will be removed using calcined dolomite according to formula No.2 above, overflow water (which is supposed to be used in this stage as washing clear water will be stored in open tanks.

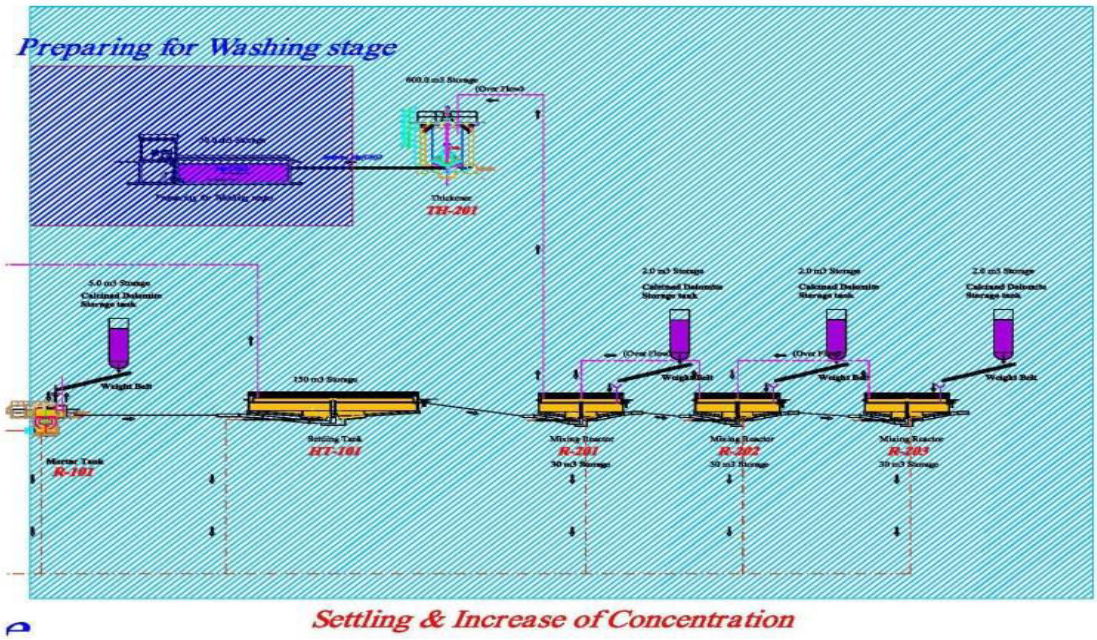
$Mg(OH)_2$ supposed to be washed using stored clear water from above , in this stage NaCL will be reduced in concentration from 27,000 ppm to 12,000 ppm .over flow will be discharged to sea .settled sludge will be moved from 1st stage washing to 2nd stage washing to reduce the NaCL concentration from 12,000ppm to about 5,000 ppm , over flow water from 2nd stage settling tank will be returned back to 1st stage tank tank, settled sludge from 2nd stage settling tank that contained $Mg(OH)_2$ will be moved to stage 8.which is the filtration and calcined



MgO production , from Gulf Sea Water & Calcined Dolomite
Hydraulic profile for preparing Mg(OH)2 Stages

8th -$Mg(OH)_2$ will be filtered to increase its concentration from 25 % to 50% , then burned to change it to MgO.

Mg)$OH)_2$ will be pumped using high pressure pumps to gravity filter which will mainly separate the cake deposit that contained 50% $Mg(OH)_2$ from the filtered water that will be returned back to settled water tank.

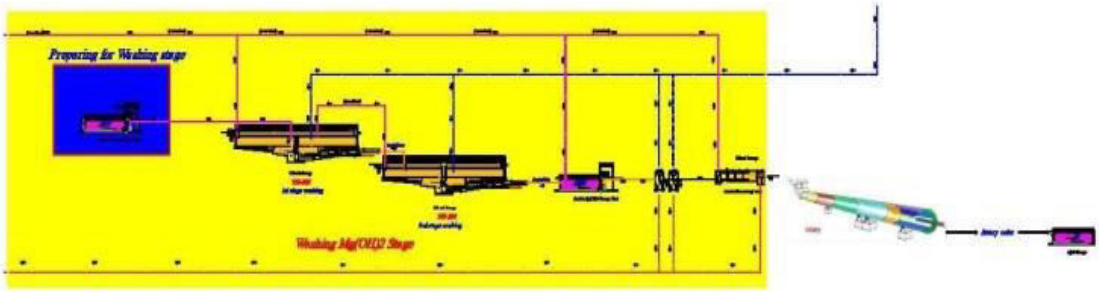


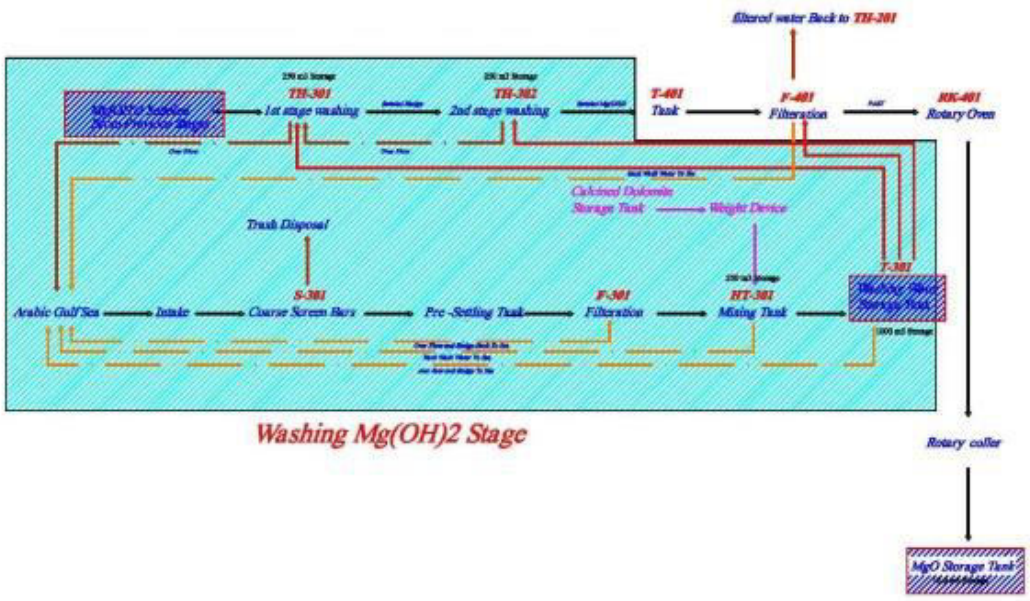
Settling & Increase of Concentration

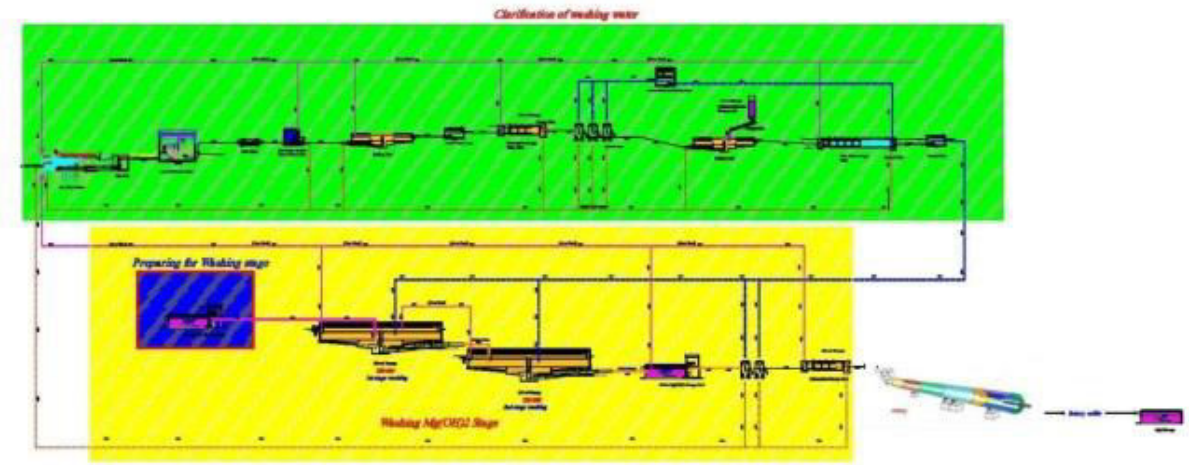
Cake deposit will be moved using laburers or mechanically using scrapers, then by conveyors belt to rotary Kiln Lining oven.in which all Mg $(OH)_2$ will be calcined in temp. 1500 deg. Centigrade. Using direct burning to inshore burns of all mixed gasses as per formula

$Mg(OH)_2 \rightarrow MgO + H_2O$ ….. (5)

The MgO will be moved to cooling rotary devise and Air will be sucked out using exhausted fan. Cooled MgO to about 400 Deg. Centigrade will be stored in special storage tanks.







5-2 - Mas balance

1st – from almost all references [26,27,28] production of 1.0 Ton of MgO from the seawater will need about 250.0 m^3 of Sea water. Then 5.0 Ton/day of MgO will need 1250.0 m^3/day, or 52.1 m^3/hr. (The plant is assumed to be working 24 hr./day.

2nd – To calculate $MgCl_2$ & $MgSO_4$ that is reacted in tank HT-101, we need to calculate MgO soluble in Gulf Sea water

MgO in seawater = 52.100 l/hr * 2.2 mg/l = 114,620.0 mg /hr

Or= 114.62 Kg /hr

3rd – Estimated loss in soluble MgO at tank HT-101 is about 10% and eq. To 11.462 Kg/hr. As the concentration of $MgSO_4$ in seawater is about 1.668 g/l

Then $MgSO_4$ in Sea water is = 1.668 mg/l * 52.1 00 l/hr = 86.903 mg/hr = 86.903Kg/hr.

Estimated Qnt. Of MgO, that can be produced from $MgSO_4$ is = (86.902*40)/120 = 28.95 Kg / hr.

As the concentration of $MgCl_2$ in Sea water is = 4.176 g / l

Then Total Qnt. Of $MgCl_2$ in Sea water is calculated to be = 4.176 g / l * 52.1 m3/hr. = 217.5 Kg / hr.

Then MgO, that can be produced from $MgCl_2$ is = (217.5 Kg/hr. * 40) / 95 = 91.57 Kg/hr.

Also Produced MgO from $MgSO_4$ to produce MgO from $MgCl_2$ is calculated to be = 28.95 / 91.57 = 0.32

Then Qnt. Of MgO from $MgSO_4$ reacted in Tank HT-101 is = (120/40)/2.86= 8.6 Kg / hr.

Then MgO from $MgCl_2$ = (3/4) * 11.46 = 8.6 Kg / hr.

Total $MgCl_2$ reacted in tank HT-101 = (95/40) * 8.6 = 20.4 Kg / hr.

4^{th} - To calculate Qnt. Of $Ca(HCO3)_2$ reacted in HT-101:-

Percentage of $Ca(HCO_3)_2$ in Sea Water 0.178 g /l

Then Qnt. Of $Ca(HCO_3)_2$ from Gulf Sea water is = (52.1 m^3/hr. *1000 l/m3* 0.178 g/l) / 1000 = 0.29 Kg/hr.

As $Ca(HCO_3)_2$ -→$2CO_2$ + CaO +H_20

$Ca(HCO_3)_2$ moles is calculated to be (9.29/162) = 0.057 Kmole

Then Qnt. Of CO_2 will be reduced in this stage from 96% to 25%, and the reaction efficiency is (96-25) l 96 = 74%

Then CO_2 is removed in HT-101 is = 0.74*5.045 = 3.73 Kg/hr.

Then reacted $Ca(OH_3)_2$ reacted is = 162*0.085*(1/2)= 6.86 Kg/hr.

Left Ca(HCO3)2 = 0.27 – 6.86 = 2.4 Kg / hr.

5^{TH} – Reaction Occurred In HT-101 with reference to chemical equation No.3

$MgCl_2$ moles are = 20.4/95 = 0.215

Total reacted materials are: - 15.9 Kg/hr. $Ca(OH)_2$, 12.47 Kg/hr.$Mg(OH)_2$, 20.425 Kg/hr. $MgCl_2$

Total Product materials are :- 24.94 Kg/hr. $Mg(OH)_2$, 23.86 Kg/hr. $CaCL_2$

Setteled $Mg(OH)_2$ = 24.94 Kg/hr. -12.47 Kg/hr. = 12.4 Kg/hr.

6^{th} – with reference to chemical reaction in equation No. 4

$MgSO_4$ reacted = 8.6/120 = 0.07 Kmole /hr.

Reacted material's Kg/hr. = $Ca(OH)_2$ = 5.3 , $Mg(OH)_2$ = 4.16 , H_2O = 2.58 , $MgSO_4$ = 8.6

Produced material's Kg/hr. = $Mg(OH)_2$ = 8.32 , $CaSO_4.2H_2O$ = 12.33

Then $Mg(OH)_2$ Settled from Gulf Sea Water = 8.32 – 4.16 = 4.14 Kg / hr.

And total $Mg(OH)_2$ – 12.47 + 4.16 = 16.63 Kg / hr.

7^{th} - with reference to chemical reaction in equation No. 3

$Ca(HCO_3)_2$ = 6.86 / 162 = 0.042 Kmole / hr.

Reacted material's = $Ca(OH)_2$ = 3.134 , $Ca(HCO_3)_2$ = 6.86 Kg/hr.

Produced material's = $CaCO_3$ = 8.47 , H_2O = 1.524 Kg/hr.

8th – Water required to be mixed with Dolomite in reactor R-101, using equation No.1:-

$Ca(OH)_2$ Reacted in HT-101 = 3.134 + 5.3 + 15.9 = 24.334 Kg/hr.

$Ca(OH)_2$ moles = 24.334 / 74 = 0.328 Kmole / hr.

Reacted material's MgO -13.153 , CaO = 18.415 , H_2O = 11.838 Kg/hr.

Produced materiuals $Mg(OH)_2$ =19 , $Ca(OH)_2$ =24.334

Then Total Calcined Dolomite interred to reactor R-101 = 13.153 / 0.4 = 32.8 Kg/hr.

And total water used = 32.8 * 4 = 131.52 Kg/hr.

Chapter -3 (results and conclusions)

1st - The cheapest way to produce Mgo from Arabian Gulf water is using both Gulf sea water with dolomite.

2nd - Availability of dolomite with huge quantities and high purity, in Muthana governess in south of Iraq.

3rd - Mg concentration in Gulf Sea water about 2-3 gm/l .

4th –we have to Change sodium bicarbonate soluble in Gulf sea water to calcium carbonates.

5th -Dolomite used should be crushed and grind, then calcined to a temp. 1400 centigrade then grinds again and sieved,

6th - from almost all references, production of 1.0 Ton of MgO from Seawater we need about 250.0 m3 of Sea water.

7th - Estimated loss in soluble MgO at tank HT-101 is about 10%.

8th - concentration of $MgCl_2$ in Sea water is = 4.176 g / l

9th - MgO, that can be produced from $MgCl_2$ is = 91.57 Kg/hr.

10th - Total product materials in HT-101 with reference to chemical equation No.3 are: - 24.94 Kg/hr. $Mg(OH)_2$, 23.86 Kg/hr. CaCL2

And settled $Mg(OH)_2$ = 24.94 Kg/hr. -12.47 Kg/hr. = 12.4 Kg/hr.

11th – Total produced materials in HT-101 with reference to chemical reaction in equation No. 4:- Kg/hr. = $Mg(OH)_2$ = 8.32 , $CaSO_4.2H_2O$ = 12.33

And total $Mg(OH)_2$ = 16.63 Kg / hr.

12th – Water required to be mixed with Dolomite in reactor R-101, using equation No.1:- 131.52 Kg/hr.

13TH – Estimated annual quantities of material's used in this prototype (to produce 5.0 Ton/day MgO) are :-

Gulf Sea water = 376,000 m3 / year , calcined dolomite = 2,175 Ton / year , water with low salinity concentration (less TDS) = 39,000 m3 / year.

14th - Most of the magnesium produced in the world in a way electrochemical analysis, where the ratio of magnesium product globally this way about 85%, while the proportion of the remaining 15% produces chemical Balachtzal

RECOMMENDATION

1st – construct prototype plant with a capacity of not more than 500 kg/day MgO, and record all data.

2nd – further analysis of Gulf water near the place where the plant is proposed to be constructed.

3rd – calculate the required electricity to operate all the equipment in the proposed plant together with indirect costs, and its influence to the final product costs.

4th – the new location should be near paved and heavy traffic, roads to ashore a good and continuous availability of dolomite at site and a good marketing for final produced MgO.

5th – keep in mind that all the return slurry and settled deposits ,turbidity , overflow , and flushing water to be discharged upstream the plant intake with not less than 2000 m.

Chapter -4 (References)

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