

Industrial Use Of Corbondioxide From Mineral Carbonation A Case Study From Magnesite From Salem

T.Subramani¹, M.P.Ravichandran², S.Priyanka³

¹Professor & Dean, Department of Civil Engineering, VMKV Engineering College, Vinayaka Missions University, Salem, India

²PG Student Of Environmental Engineering, Department of Civil Engineering, VMKV Engg. College, Vinayaka Missions University, Salem, India

³UG Student, , Department of Civil Engineering, VMKV Engineering College, Vinayaka Missions University, Salem, India

ABSTRACT

Magnesite is a mineral with the chemical formula $MgCO_3$ (magnesium carbonate). Mixed crystals of iron(II) carbonate and magnesite (mixed crystals known as ankerite) possess a layered structure: mono layers of carbonate groups alternate with magnesium mono layers as well as iron (II) carbonate mono layers. Manganese, cobalt and nickel may also occur in small amounts. Our project describes two rather different options for carbon dioxide (CO_2) storage: (i) the fixation of CO_2 in the form of inorganic carbonates, also known as 'mineral carbonation' or 'mineral sequestration', and (ii) the industrial utilization of CO_2 as a technical fluid or as feedstock for carbon containing chemicals. In the case of mineral carbonation, captured CO_2 is reacted with metal-oxide bearing materials, thus forming the corresponding carbonates and a solid by product, silica for example. Natural silicate minerals can be used in artificial processes that mimic natural weathering phenomena, but also alkaline industrial wastes can be considered. The products of mineral carbonation are naturally occurring stable solids that would provide storage capacity on a geological time scale. Moreover, magnesium and calcium silicate deposits are sufficient to fix the CO_2 that could be produced from the combustion of all fossil fuels resources. To fix a tonne of CO_2 requires about 1.6 to 3.7 tonnes of rock. From a thermodynamic viewpoint, inorganic carbonates represent a lower energy state than CO_2 ; hence the carbonation reaction is exothermic and can theoretically yield energy. However, the kinetics of natural mineral carbonation is slow; hence all currently implemented processes require energy intensive preparation of the solid reactants to achieve affordable conversion rates and/or additives that must be regenerated and recycled using external energy sources.

Keywords : Industrial Use, Corbondioxide, Mineral Carbonation, Case Study, Magnesite, Salem

1.INTRODUCTION

1.1 Occurrences Of India In Magnesite Deposites

In India, magnesite deposits are found in the states of Himachal Pradesh, H.P., Jammu and Kashmir (J & K), Karnataka, Kerala, Rajasthan, Tamilnadu (T.N.), and Uttar Pradesh (U.P.). The deposits in HP belong to Carboniferous age, that of U.P. occur in rocks belonging to Permian age, and those in T.N. and Karnataka are confined to formations of Pre cambrian age. However, the economic deposits are found in the Salem district of Tamilnadu followed by relatively less economic deposits in Karnataka, and Almore and Pithoragarh districts of U.P.

1.2 Tamil Nadu (T.N.)

Tamil Nadu is the largest magnesite producing state. Here, Dharmapuri, Nilgiris, North Arcot, Periyar, Salem, Trichy and Thirunelveli. The rock types associated with the mineral are mostly ultra basic bodies such as peridotite, dunite and pyroxenite. These deposits are considered to be of Pre-Cambrian age. Though magnesite is available in many districts of T.N. Chalk Hills area of Salem district alone which forms the largest producer of refractory grade magnesite in T.N.

1.2.1 Chalk Hills Area

The Chalk Hills area known for its magnesite potential is located 7 k.m. N.E. of Salem on the Salem - Bangalore highway. Commercial exploration and exploitation in Chalk Hills commenced as early as 1900 AD and at present, the area is under mining lease to different government and private agencies. The area is a plain country with detached hills

rising to 609 n. from a general ground Level of 340 m. The Shevaroy Hills to the north rises to 1625 m. from MSL. The Chalk Hills area has spare drainage, The ultramafic rock is characteristically devoid of vegetation while the adjoining gneissic country supports vegetation.

2.STUDY AREA

Salem district is also called the singhbhum of South India and it is known to be the geological paradise of the state. The natural gemstone is a mineral, stone or organic matter that can be cut and polished. These gem varieties can be categorized as precious, semi-precious and rare varieties. Larger percentage of high grade metamorphic type is attributed to many of the gem deposits. Salem has the total area of 19.94 sq kms with Latitude of N 11°19' to 11° 58' and Longitude of E 77° 40' to 78° 50'. The mine is situated at a distance of 5 km from salem town. The run of the hill range is NW-SE. The aspect is North East & South West. It has an average elevation of 278 metres (912 ft). The rivers in Salem are Thirumanimuthar, Vasishta Nadi, Kaveri, Sarabanga nadi. Salem district is surrounded by high grade of metamorphic rock and it has a higher density of gem deposits compared to its landmass and only a very small area is still mined. The gemstones found in this area are associated with pegmatites, carbonatites, syenites, pyroxenite and related alkaline rocks.

Further, gem potential maps or compressive database have not been prepared in the Salem district with proper scientific background. The geographical information system (GIS) used to represent and understand the spatial data. GIS can help in many aspects of the mineral exploration activities: such as data collection, management, analysis, and reporting. Field geologists can now capture field data electronically, using global positioning system (GPS) receivers. All of these data sets can be integrated, manipulated, and analyzed using GIS. Thus this research focuses on mapping of potential zones of gem mineral deposits using GIS technique in Salem. Figure. 1 shows Salem district map. Figure. 2 shows Geology map of Salem district .

2.1 Geology

The major ore deposits in Salem are Magnesite, Limestone, Granite, Bauxite.

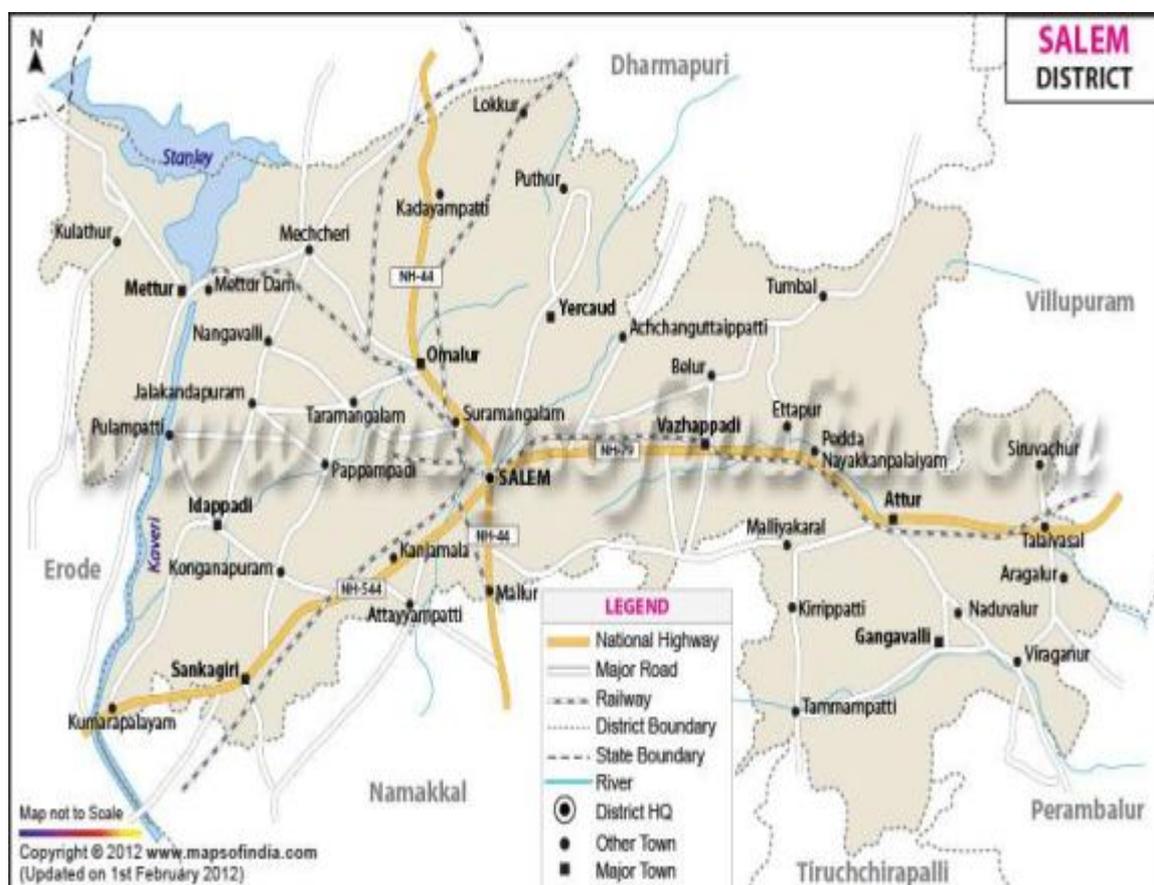


Figure. 1 Salem district map

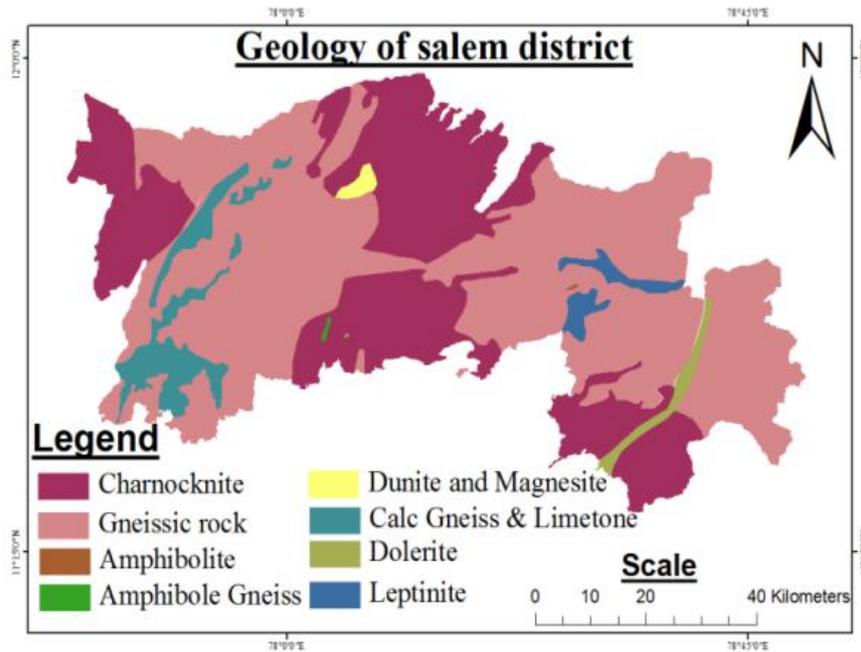


Figure. 2 Geology map of Salem district .

2.1.1 Magnesite

One of the world’s best Magnesite deposit occur in Salem. The Magnesite reserves in Tamil Nadu are about 73 million tonnes. Magnesite is used mainly for refractory purposes and in chemical industries. The major Salem district based players in this field are Tamil Nadu Magnesite (TANMAG), a State Government organisation, Burn Standard, a Government of India organization and Dalmia Magnesite.

2.1.2 Limestone

Tamil Nadu ranks seventh in the country in terms of production of Limestone. Lime stone based Cement and Chemical industries have been flourishing for the past three decades as cement grade limestone deposits are abundant in the State. The total limestone reserves are about 1,473 million tonnes. There are 12 major cement plants functioning in the State. The major players are Tamil Nadu Cements (TANCEM), Dalmia Cements, Madras Cements, India Cements, Grasim Industries, Associated Cement Companies and Chettinad Cements.

2.1.3 Granite

Tamil Nadu is endowed with vast resources of Granite of different colours and shades. The total reserves of granite are about 710 million cubic metres. Granites are used in building facading, flooring, decorative& ornamental uses and in Monuments. Black Granite and other coloured Granites occurs in salem districts. The major players are the Tamil Nadu Minerals(TAMIN), a Government of Tamil Nadu Enterprise, P.R.P. Granites, Gem Granites, Pallava Granites, Rani Granites and Enterprising Enterprises. Figure.3. shows potential zones of gem mineral deposits.

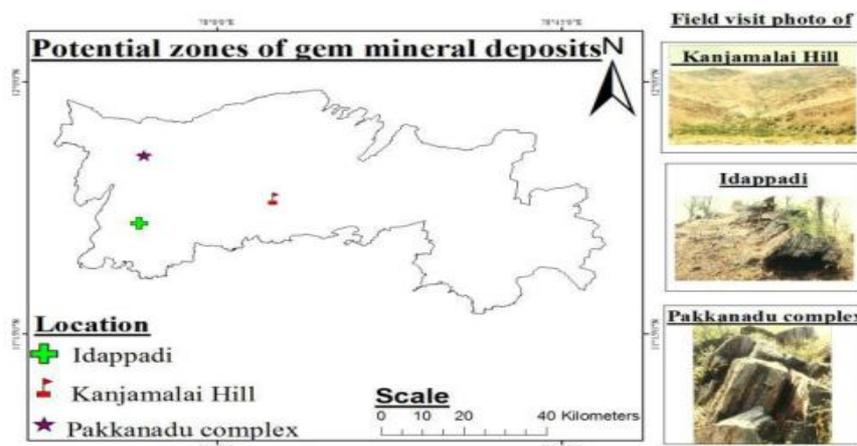


Figure.3. Potential zones of gem mineral deposits.

3. MINERAL CARBONATION

Mineral carbonation is the fixation of CO₂ as stable carbonate minerals, such as calcite (CaCO₃), dolomite (Ca_{0.5}Mg_{0.5}CO₃), magnesite (MgCO₃) and siderite (FeCO₃). Insight into the potential effectiveness of storing atmospheric CO₂ as carbonate minerals is demonstrated by the relative volume of these reservoirs worldwide. The total mass of carbon currently in the atmosphere is approximately 800 gigatons (Gt). In contrast, ~39,000,000 Gt of carbon are currently present in carbonate rocks, such as marble, limestone and chalk, in the Earth's crust. Extensive evidence on the anthropogenic cause of climate change can be obtained from the comprehensive IPCC report published in 2007. There is a general agreement that to meet the ambitious target to stabilize atmospheric CO₂ concentration at 500 ppm by 2050, a large portfolio of technologies need to be considered, where Carbon Dioxide Capture and Storage (CCS) represents a leading technology, particularly in the transition from a fossil fuel based economy to a renewable based economy.



Figure 4. Potential mineral hosts of CO₂ calcite, (C) magnesite.

3.1 Minerals & Mineral Based Products

India continued to be wholly or largely self-sufficient in minerals which constitute primary mineral raw materials to industries, such as, thermal power generation, iron & steel, ferro-alloys, aluminium, cement, various types of refractories, china clay-based ceramics, glass, chemicals like caustic soda, soda ash, calcium carbide, titania white pigment, etc. India is, by and large, self sufficient in coal (with the exception of very low ash coking coal required by the steel plants) and lignite among mineral fuels; bauxite, chromite, iron and manganese ores, ilmenite and rutile among metallic minerals; and almost all the industrial minerals with the exception of chrysotile asbestos, borax, fluorite, kyanite, potash, rock phosphate and elemental sulphur. Figure 4. Shows Potential mineral hosts of CO₂

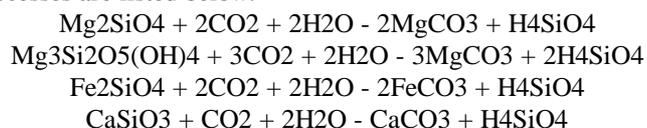
Despite high degree of self-sufficiency, some quantities of flaky and amorphous graphite of high fixed carbon, kaolin and ball clay for special applications, very low-silica limestone, dead-burnt magnesite and sea-water magnesia, battery grade manganese dioxide, etc.

3.3 CO₂ Sequestration By Mineral Carbonation

Mineral carbonation (MC) is an accelerated form of weathering of naturally occurring silicate rocks and has been proposed as an alternative approach for CO₂ sequestration since the 1990s. Some MC technologies have recently approached the commercial stage. MC is defined as the reaction of metal oxide bearing materials with CO₂ to form insoluble carbonates:

Metal oxide + CO₂ - Metal carbonate + Heat (1)

Relates to above-ground processes, which requires rock mining and material commutation as MC pre-requisites. MC can take advantage of different starting materials, which include Mg-silicate minerals and Ca- or Fe-rich silicates. The reactions occurring in MC processes are listed below.



CCS by geological storage represents the best CCS strategy for large emitters, while MC can play an important role by targeting small and medium emitters (2.5 Mt CO₂), which account for about 10–15% of the total CO₂ emissions. 10 Mineral carbonation is a permanent and safe way for storing CO₂, which does not present potential concerns over long term monitoring and liability issues, such as geological storage.

3.4 Chemistry Of Mineral Carbonation

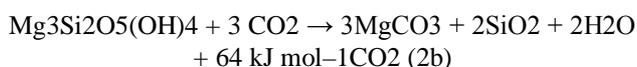
When CO₂ reacts with metal oxides (indicated here as MO, where M is a divalent metal, e.g., calcium, magnesium, or iron) the corresponding carbonate is formed and heat is released according to the following chemical reaction: The amount of heat depends on the specific metal and on the material containing the metal oxide. In general this is a large fraction (up to 46% in the case of calcium oxide) of the heat released by the upstream combustion process forming CO₂.

(393.8 kJ mol⁻¹CO₂ for combustion of elemental carbon). In the case of a few natural silicates the following exothermic chemical reactions take place (in all cases heat values are given per unit mol of CO₂ and standard conditions 25°C and 0.1 MPa).

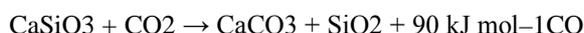
3.4.1 Olivine



3.4.2 Serpentine



3.4.3 Wollastonite



Since the reaction releases heat, the formation of carbonates is thermodynamically favoured at low temperature, whereas at high temperature (above 900°C for calcium carbonate and above 300°C for magnesium carbonate, at a CO₂ partial pressure of one bar) the reverse reaction, that is calcination, is favoured. The representative member of the olivine family considered in the first reaction above is forsterite, which is iron-free. In nature.

4. EXPERIMENTS ON MINERAL CARBONATION

4.1 Process Routes For Mineral Carbonation

Binding carbon dioxide in carbonates can be achieved through various process routes as described in our project, ranging from the most basic accelerated weathering of limestone to advanced multistep processes. Many of the process routes suggested to date have already been abandoned, but research especially around aqueous mineral carbonation has continued. The following sections are intended to contain the recent developments and results achieved in the art of mineral carbonation. Each main heading (e.g. Direct carbonation) is divided into several sub-headings and each sub-heading is further divided (whenever literature was found) into carbonation processes using naturally occurring minerals and processes using solid process residues as feedstock.

- Direct carbonation.
- Indirect carbonation.
- Other processes.

4.2 Direct Carbonation

The mechanical grinding approach aims at destroying or disordering the mineral lattice, and thus, resulting in an increase of the surface area. Particle size reduction takes place in a sequence of crushing and grinding stages required to reduce the particle size to 0.300 mm which can be necessary to liberate valuable mineral grains. Crushing is normally performed on dry materials using compression equipment such as jaw or cone crushers. Instead, grinding is accomplished by abrasion and impact of the ore by the free motion of unconnected grinding media such as rods, balls, or pebbles.

4.2.1 Direct Gas-Solid carbonation

Gas-solid carbonation is an even more simple approach towards mineral carbonation than direct aqueous mineral carbonation. Here particulate metal oxides are brought into contact with gaseous CO₂ at a particular temperature and pressure (for various temperature and pressure ranges applied). The dry process has the potential of producing high temperature steam or electricity while converting CO₂ into carbonates. Process integration with mining activities may be very advantageous from an economic point of view of the cost and energy, possibly allowing for, e.g., higher valuable metal extraction rates as well.

4.2.2 Gas-Solid Carbonation Of Solid Residues

One of the important benefits of using industrial solid residues as feedstock for carbonation compared to the carbonation of mineral ores is the possibility of utilizing a waste stream. The possibility of simultaneously binding CO and lowering the hazardous nature of e.g. municipal solid waste incinerator (MSWI) ash makes this carbonation route interesting. However, the potential CO₂ storage capacity for this option is limited, simply because the amounts of material that may be carbonated are too small.

4.2.3 DIRECT CARBONATION WITH THERMAL PRE-TREATMENT

As previously mentioned, serpentine requires additional thermal treatment to remove hydroxyl groups, resulting in the chemical transformation to pseudo-forsterite. Serpentine requires heating treatment above 630 °C to remove chemically bound water from the lattice $89 \text{ Mg}_3\text{Si}_2\text{O}_5(\text{OH})_4 - (\text{MgO})_3(\text{SiO}_2)_2 + 2\text{H}_2\text{O}$

The NETL findings indicate that the reaction rate for serpentine was slow if water (OH groups) was not removed. Thermally treated serpentine at 630 °C for 2 hours reached 65% CO₂ storage capacity. Similar results were obtained with high energy attrition grinding, but with a substantial associated energy penalty.^{54, 82} The theoretical energy required for the heat activation process is the sum of the energy to heat the mineral to 630 °C and the enthalpy of dehydroxylation.

Optimising Direct Aqueous Carbonation

Considering the non-complete conversion of the minerals, the mineral amounts required significantly exceed the theoretical amount, estimated that it would require 6.5–8.9 tons of serpentine or around 8.9 tons of wollastonite for every ton of CO₂ sequestered (compared to the theoretical amount of 2.1 and 2.6 ton mineral/ton CO₂). Therefore it is very important to consider the environmental (and economic) impact of the necessary mining operations related to ex situ CO₂ sequestration, including product material disposal/utilization. Figure. 5 shows Mineralization process concept for pure CO₂ and flue gas

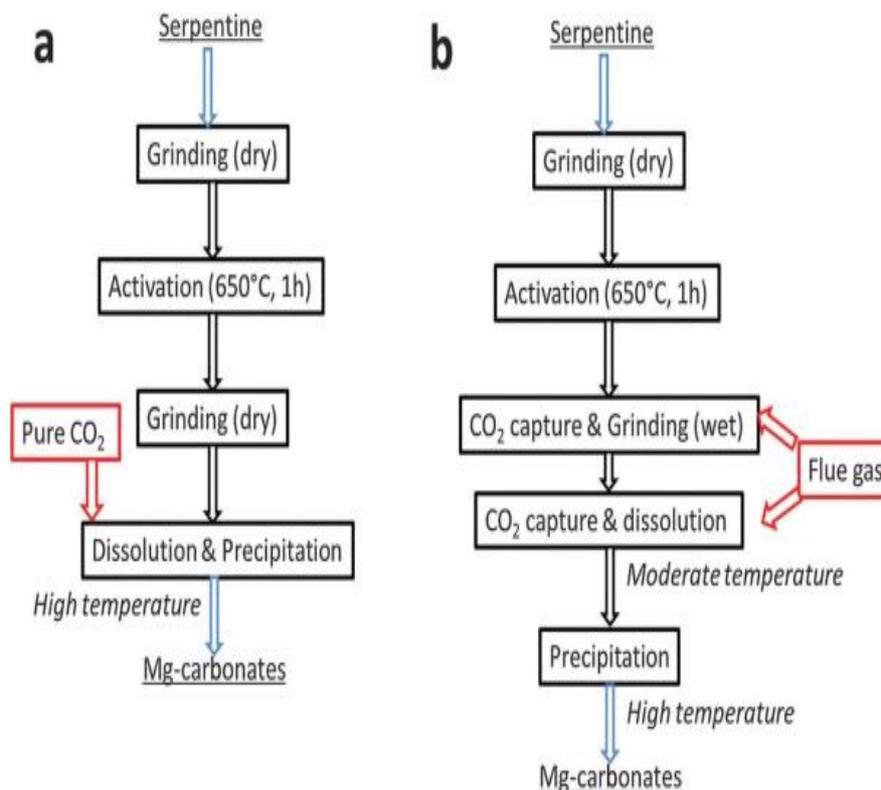
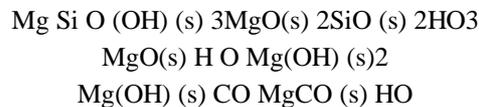


Figure. 5 Mineralization process concept for pure CO₂ and flue gas

Work on finding optimal aqueous carbonation conditions is ongoing and even though it has been studied extensively over the past two years, some questions still remain unanswered. For example increasing the L/S has been reported to have both a positive and a negative effect on CO conversion.

4.3.2 Multistage Gas-Solid Carbonation Of Minerals

It has been found that the carbonation of MgO is significantly slower than the carbonation of Mg(OH)₂. Using this observation, suggested (noting that Mg(OH)₂ production from serpentine in one step cannot be done because of thermodynamic limitations) that the direct gas-solid carbonation process should be divided into three-steps; MgO production in an atmospheric reactor followed by MgO hydration and carbonation at elevated pressures according to the following reaction.



A wide number of strong acids and bases such as HCl, H₂SO₄ and HNO₃ have been employed for the dissolution of silicate rocks. 2-stage process, where serpentine is decomposed to magnesium hydroxide using HCl at 150 °C. The resulting Mg(OH)₂ was then carbonated at 325 °C for 2 hours in a fixed bed at atmospheric pressure.¹⁰⁸ However, because the authors did not address the recovery of the chemicals used in the process and the time required for dissolution was too long compared to the precipitation stage, the process was not attractive. Maroto-Valer et al.¹⁰⁹ developed a process, where serpentine was chemically activated with H₂SO₄ at a temperature 20–65 °C for 3–12 hours. The resulting magnesium sulphate was reacted with sodium hydroxide to precipitate Mg(OH)₂ following an exothermic reaction. Mg(OH)₂ subsequently reacted with CO₂ in aqueous suspension at 20 °C and 40 bar. A conversion of 55% was achieved in 10 minutes under these mild conditions. Sulphuric acid was regenerated by reacting CO₂ with MgSO₄.¹⁰⁹ However, Chemicals make up and intensive chemical regeneration hindered the deployment of this process.

5.FUTURE SCOPE

5.1 Public Acceptance

Public acceptance of mineral carbonation is contingent on the broader acceptance of CCS. Acceptance might be enhanced by the fact that this method of storage is highly verifiable and unquestionably permanent. On the downside, mineral carbonation involves large-scale mining and associated environmental concerns: terrain changes, dust pollution exacerbated by potential asbestos contamination and potential trace element mobilization. Generally, public acceptance will require a demonstration that everything possible is done to minimize secondary impacts on the environment.

5.2 Gap Analysis

Mineral carbonation technology must reduce costs and reduce the energy requirements associated with mineral pretreatment by exploiting the exothermic nature of the reaction. Mineral carbonation will always be more expensive than most applications of geological storage, but in contrast has a virtually unlimited permanence and minimal monitoring requirements. Research towards reducing costs for the application of mineral carbonation to both natural silicates and industrial wastes, where the kinetics of the reaction is believed to be more favourable, is ongoing. Moreover, an evaluation is needed to determine the fraction of the natural reserves of silicates, which greatly exceed the needs, that can be effectively exploited for mineral carbonation. This will require thorough study, mapping the resources and matching sources and sinks.

6.CONCLUSION

In situ CO₂ mineralization offers the potential for long term, safe CO₂ storage at a reasonable price. Optimizing this technology, however, will require a multifaceted effort, including field-scale pilot studies, to better characterize the rates of mineral carbonation reactions and the fate and consequences of injecting CO₂ into reactive silicate rocks. Another aspect of mineral carbonation that has received comparatively little attention to date is the destiny of the CO₂-containing end product. If mineral carbonation becomes a large-scale CO₂ sequestration alternative, the amount of carbonates produced would be very large and consequently disposal would be problematic. However, mineral carbonation might never become a global scale industry. The impact on carbon dioxide mitigation of the carbon chemical pool does not depend on the amounts of carbon containing chemical products produced; there is CO₂ emission reduction in a certain time only if the pool has grown during that time. With increasing production, such impact can be positive or negative, as shown above. It is clear that since this would be a second or third order effect with respect to the overall production of carbon containing chemicals – itself much smaller in terms of fossil fuel consumption than fossil fuel combustion – this impact will be insignificant compared with the scale of and emissions.

References

- [1] T.Subramani, . “Study of Air Pollution Due to Vehicle Emission in Tourism Centre” International Journal of Engineering Research and Applications, Vol.2, Issue.3, pp 1753-1763, 2012.
- [2] T.Subramani,, “Study of Pollution Prevention Strategies For Reclamation and Waster Management of Lake in Tourism Place”, International Journal of Modern Engineering Research,Vol.2, No.3, pp 763- 773,2012
- [3] T.Subramani,, M.Kavitha.M.P. K.and Sivaraj K.P., “Modelling of Traffic Noise Pollution ” International Journal of Engineering Research and Applications, Vol.2, Issue.3, pp 3175-3182, 2012.
- [4] T.Subramani, . “Study of Pollution Prevention Strategies For Reclamation of Ooty Lake” International Journal of Engineering Research and Applications, Vol.2, Issue.3, pp 783-791, 2012.
- [5] T.Subramani., P.Anitha., S,Sekar., “Health-Care Waste Management System”, International Journal of Engineering Research and Applications, Vol. 4, Issue 6(Version 2), pp.255-258, 2014.
- [6] T.Subramani. , D.Kavitha., R.Tiyagu., “Treatment Of Municipal Waste Water In Salem City”, International Journal of Engineering Research and Applications, Vol. 4, Issue 6(Version 2), pp.259-263, June 2014.
- [7] T.Subramani. , M.Mangaiyarkarasi. , C.Kathirvel., “ Impact Of Sewage And Industrial Effluent On Soil Plant Health Act On Environment”, International Journal of Engineering Research and Applications, Vol. 4, Issue 6(Version 2), pp.270-273, 2014.
- [8] T.Subramani. , V.Vishnumanoj., “Land Use and Land Cover Change Detection and Urban Sprawl Analysis of Panamarathupatti Lake, Salem”, International Journal of Engineering Research and Applications, Vol. 4, Issue 6(Version 2), pp.117-127, 2014.
- [9] T.Subramani., J.AkelaJ “Onsite Waste Water Treatment System”, International Journal of Engineering Research and Applications, Volume. 4, Issue. 6 (Version 5), pp 154 - 162, 2014.
- [10]T.Subramani., C.Arulsankar., S.Badrinayanan., “Effect Of Sewage Farming On Ground Water”, International Journal of Engineering Research and Applications, Volume.,Issue. 6 (Version 5), pp 163 - 172.
- [11]T.Subramani., Arutselvan, S.K.Ganesan. , “Analysis Of Highway Air Pollution” International Journal of Engineering Research and Applications, Volume. 4, Issue. 6 (Version 5), pp 173 - 182, 2014.
- [12]T.Subramani., N.Jayagobu. , “Microbial Analysis Of Drinking Water And Water Distribution System”, International Journal of Engineering Research and Applications, Volume. 4, Issue. 6 (Version 5), pp 183 - 193, 2014.
- [13]T.Subramani., A.Subramanian., C.Kathirvel., S.K.Bharathi Devi., “ Analysis and Site Suitability Evaluation for Textile Sewage Water Treatment Plant in Salem Corporation, Tamilnadu Using Remote Sensing Techniques” , International Journal of Engineering Research and Applications , Vol. 4, Issue 8(Version 6), pp.90-102, 2014.
- [14]T.Subramani, R.Vasantha Kumar, C.Krishnan “Air Quality Monitoring In Palladam Taluk Using Geo Spatial Data”, International Journal of Applied Engineering Research (IJAER),Volume 10, Number 32, Special Issues pp.24026-24031,2015
- [15]T.Subramani, P.K.Revathi, “Production Of Activated Carbon From Agricultural Raw Waste”, IOSR Journal of Engineering, Volume 5, Issue 5, Version 3, pp 54-63, 2015
- [16]T.Subramani, S.Praveen Kumar , " Generation Of Biogas From Organic Waste In Salem Tamil Nadu" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 5, Issue 5, pp. 104-115 , 2016 .
- [17]T.Subramani, S.Sounder , " A Case Study And Analysis Of Noise Pollution For Chennai Using GIS" , International Journal of Emerging Trends & Technology in Computer Science (IJETTCS) , Volume 5, Issue 3, pp. 125-134 , 2016.
- [18]T.Subramani, A.Ravi , " Study Of Air Pollution Due To Magnesite in Salem District" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 5, Issue 5, pp. 162-172 , 2016 .
- [19]T.Subramani, . “Traffic Study On Road Network And Programming For Fixing Priority To The Identified Transport Improvement Projects In Salem City, Tamilnadu, India”, International Journal of Scientific and Engineering Research, Vol.3, No.5, pp 1-12, 2012.
- [20]T.Subramani., and R.Elangovan, “Planning Of A Ring Road Formation For Salem Corporation Using GIS”, International Journal of Engineering Research And Industrial Applications, Vol.5, No.II, pp 109-120, 2012.
- [21]T.Subramani., R.Elangovan, and P.K.Kumaresan “Identify The Transport Infrastructure Improvement Projects In Salem City - Case Study” International Journal Of Research In Management and Technology, Vol.2, No.2, pp180-183, 2012
- [22]T.Subramani., .P.Someswari., “Identification And Analysis Of Pollution In Thirumani Muthar River Using Remote Sensing”, International Journal of Engineering Research and Applications, Vol. 4, Issue 6(Version 2), pp.198-207, 2014.

AUTHOR



Prof. Dr.T.Subramani Working as a Professor and Dean of Civil Engineering in VMKV Engineering College, Vinayaka Missions University, Salem, TamilNadu, India. Having more than 27 years of Teaching experience in Various Engineering Colleges. He is a Chartered Civil Engineer and Approved Valuer for many banks. Chairman and Member in Board of Studies of Civil Engineering branch. Question paper setter and Valuer for UG and PG Courses of Civil Engineering in number of Universities. Life Fellow in Institution of Engineers (India) and Institution of Valuers. Life member in number of Technical Societies and Educational bodies. Guided more than 400 students in UG projects and 300 students in PG projects. He is a reviewer for number of International Journals and published 174 International Journal Publications and presented more than 25 papers in International Conferences.



M.P.Ravichandran received his B.E. Degree in the branch of Civil Engineering in VMKV.Engineering College, Vinayaka Missions University, Salem, TamilNadu, India.. Currently he is doing his ME Degree in the branch of Environmental Engineering in the division of Civil Engineering in VMKV Engineering College, Salem.



S.Priyanka is persuing B.E. Degree in the branch of Civil Engineering in V.M.K.V.Engineering College, Vinayaka Missions University, Salem. She has illustrious career in her intermediate and matriculation exams, her hobby is cooking and surfing internet.