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A STUDY ON AVAILABILITY OF THORIUM IN BEACH SAND MINERALS AND ITS VALUE AS A RENEWABLE RESOURCES

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ABSTRACT

Among the beach sand minerals is monazite, the mineral from which thorium is extracted. Thorium is a key ingredient of India's three-stage nuclear programme that can be turned into nuclear fuel after being combined with a fissile material such as plutonium. Since the other beach sand minerals and monazite generally occur together, companies handling beach sand minerals were earlier required to get a license from the atomic sector regulator AERB (Atomic Energy Regulatory Board), with the licensing conditions requiring the licensee to, after separating the beach sand minerals, dispose of the tailings, which contain monazite, within its company premises or as backfill. Inspectors from AERB then surveyed these areas to ensure the licensing conditions were met. In Kerala and Orissa, the beach contains monazite, ilmenite, baguette, rutile, garnet and sillimanite. Mining and product of these minerals was reserved for the public sector but in 1998 policy changed to allow picky entry of

the private sector. Now, Private enterprises can prize and sell rare ores similar to garnet and ilmenite from these beaches but they can not reuse or vend radioactive monazite leaves. They ’ve to store it at their own cost or fill it back in the mines. The strands of Kerala and Orissa, hold 70% of India's estimated monazite reserve of 18 million tonnes. The Department of Atomic Energy wants the Government to amend this policy- with a new provision that Private enterprises should hand over these monazite leaves to Indian Rare Earths(IREL) – which will also reuse it and try to prize thorium. And this thorium can be also used as energy in the Nuclear reactors. For the purpose of the study empirical research is used. It helps to understand the behavior of an individual, group or a society. Convenient sampling method is used in this study for collecting the samples. Samples are collected based on the ease of availability of respondents. 200 samples-sample size. Independent variables are age, gender, educational qualification, occupation. Dependent variables are thorium as nuclear fuel, beach sand minerals, renewable resources. Pie Chart and Bar Graphs are used as research tools.

KEYWORDS

Beach Sand Minerals, Thorium, Monazite, Nuclear Fuel, Minerals

INTRODUCTION

Among the sand beach minerals is monazite, the mineral from which thorium is uprooted. Thorium is a crucial component of India’s three- stage nuclear programme that can be turned into nuclear energy after being combined with a fissile material similar to plutonium. Since the other sand beach minerals and monazite generally do together, companies handling sand beach minerals were before needed to get a license from the infinitesimal sector controller AERB(Atomic Energy Regulatory Board), with the licensing conditions taking the designee to, after separating the sand beach minerals, dispose of the chase, which contain monazite, within its company demesne or as backfill. Inspectors from AERB also surveyed these areas to ensure the licensing conditions were met.

These rules were tensed precipitously by the NDA Government from 2015 onwards, all the way up to the July 2019 announcement, to effectively circumscribe the conditioning of the private sector in the mining of virtually all these minerals. The AERB stopped renewing the license for operation of mineral separation shops by these private parties under Atomic Energy(Radiation Protection) Rules 2004 for radiological safety considerations. The Ministry of Mines and the Directorate General of Foreign Trade had also initiated measures to circumscribe private sector involvement, including through the specific action calling that the exports of these minerals were done through state- held channeling agents. The Beach Sand and Offshore examinations(BSOI) Group is entrusted with the exploration and evaluation of BSMs associated with oceanfront sacrifice deposits confined to East and West sand fronts of India in general as well as inland sand bodies(palaeo- beach ridges), inland clod and red sediments/ teri sand along East coast in particular. The Department of Atomic Energy wants the Government to amend this policy- with a new provision that Private enterprises should hand over these monazite

leaves to Indian Rare Earths(IREL) – which will also exercise it and try to prize thorium. And this thorium can be also used as energy in the Nuclear reactors. A 300 MW nuke- reactor requires 50 tonnes of energy in its core first and about 5 tonnes later each time. Given the amount of thorium rich strands we 've in Kerala and Orissa, we can give continuous force of energy to our nuke- reactors multitudinous times. The origin of the thorium deposits on the West Coast of India is not well established though a number of studies on the various aspects of these deposits have been carried out for more than 50 times.

The methodology for slice of sand column in exploration for beach sacrifice deposits has evolved from hand auger to Conrad Bunka and Dormer drill units and is carried out in two stages viz.(i) slice of dry zone and(ii) slice of wet zone. In the first stage, hand- auger is generally used to test the dry zone i.e. above the water table. Subsequently, the wet zone i.e. below the water table is tried using varied drill unitsviz. Conrad Bunka, Vibro-corer or Dormer drills. The depth of slice using these manual/semi-mechanised drill units varies from 7m- 12m in general and occasionally goes up to 15m. Recently, exploration in deeper situations (up to 50m) by ' Sonic ' drilling in Chavara deposit, Kerala and Brahmagiri deposit, Odisha have indicated sizable addition of heavy mineral resources. In view of this, future works are being directed towards exploring deeper corridors of BSM deposits along the East coast of India.

OBJECTIVES

- To understand about the separation thorium from beach sand minerals
- To analyze the minerals available in beach sands
- To examine the usage of thorium as nuclear fuel
- To know about the extraction thorium from monazite

REVIEW OF LITERATURE

S.F.Ashley(2015) ("Life-Cycle Impacts from Novel Thorium–uranium-Fuelled Nuclear Energy Systems" 2015)Electricity generated from nuclear power shops is generally associated with low emigrations per kWh generated, an aspect that feeds into the wider debate surrounding nuclear power. This paper seeks to probe how life- cycle emigrations would be affected by including thorium in the nuclear energy cycle, and in particular its addition in technologies that could prospectively operate open Th –U-based nuclear energy cycles.

MR Iyer(2015) ("Website," n.d.) The origin of the thorium deposits on the West Coast of India isn't well established though a number of studies on the colorful aspects of these deposits have been carried out for more than 50 times. The deposits are believed to be washed down from mounds through water aqueducts. It's proposed that snippet rates of colorful radioactive and stable products in the uranium and thorium series as a function of time could be effectively used for the purpose. Consequently, the colorful rates have been calculated as a function of the age in the time range of 100- times.

P. Schapira(2017) ("[No Title]" n.d.) Among the natural thorium coffers, monazite and the remainders of rare-earth birth will veritably probably be exploited first in case of a significant use of thorium- grounded nuclear energies. The different waste aqueducts have been linked from the present artificial practices used in the product of nuclear grade thorium from monazite uprooted from sand beach. The radionuclides of utmost significance in colorful waste aqueducts are 232Th, 228Ra, and 220Rn from the thorium series and 238U, 230Th, 226Ra, and 222Rn from the uranium series.

Parthasarathy(2000) ("[No Title]" n.d.; Parthasarathy et al. 2000) Monazite(principal source of thorium) which is available in abundance in the sand beaches of Kerala, India, contains uranium in the range of0.25 to0.35. An attempt has been made to estimate 231Pa in monazite and the matching process sluice samples of the thorium product cycle. This paper reports the 231Pa exertion in these samples, after coprecipitation of 231Pa on MnO2 carrier and estimation by γ- shaft spectrometry. The estimation shows about 1000 Bq/ kg of 231Pa in monazite. This is the first reported estimate of 231Pa in monazite.

John Parnell(2004) (Parnell 2004) Irradiation of organic motes by mineral radioactivity is a doable volition to cosmic irradiation to precipitate solid organic carbon-rich matter on the early Earth. Radioactive(uranium- and thorium-rich) minerals have been concentrated at the Earth's face, and accumulated accretionary coatings of carbon due to irradiation, since early Archean times. The organic accretion process could have passed at the face or in the sun-surface, and is independent of a terrestrial or extraterrestrial source for the carbon.

Barthel,F.H.(2014) (Barthel and Tulsidas n.d.) Vacuity of Thorium • Monazite product can be used as a measure for Th vacuity. • Without marketable rare earth conditions recovery of Th from monazite isn't profitable. • birth of Th from deposits containing. Nb, Ta, may come profitable by- product once marketable Th conditions progress. Monazite is uprooted in India, Brazil, Malaysia. • Annually 6 300 to 7 400 t monazite between 2004 and 2008. • Largest patron India, 5 000 t monazite/a. • latterly numbers aren't available(Chinese competition on the rare earth request?). • Other monazite directors(unknown quantities) China, Indonesia, Nigeria, North and South Korea, CIS. • Theoretical content of Th in the below reported monazite 300 to 600 t Th.

RAMTANU MAITRA (2006) ("Website," n.d.) One of the most promising options for nuclear power generation is the thorium- grounded energy cycle. India is a global leader in this technology which offers several advantages, compared to the' classical' uranium- grounded process, in terms of frugality and energy effectiveness. It also makes secret military nuclear proliferation more delicate.

PORTER HOAGLAND (1998) ("Website," n.d.) We compare and discrepancy being and proposed ocean mining canons in the United States in the environment of current sweats to establish distant systems to dispose of ocean hard minerals. Broad public policy pretensions and specific" core" vittles relating to access, profit

generation, performance conditions, and information operation are considered as they impact public ocean mineral disposal.

Ana Luiza Cortez(1988) ("Website," n.d.) the debate surrounding the United Nations Convention in the Law of the Sea(UNCLOS) and the Exclusive Economic Zones(EEZ) has been extended to the realm of profitable growth and planning. Although littoral countries are making sweat to determine what coffers they've in their EEZs, little is known about the exact donation those coffers are making or potentially could make to enhance profitable growth.

Khandoker Asaduzzaman(2021) ("[No Title]" n.d.) The distribution of natural series radionuclides 226Ra, 232Th and non-series 40K in the heavy mineral-rich sand beach of largely touristic areas of Cox's Bazar ocean sand has been studied. The study is made to estimate the gamma radiation exposure to individualities with an end to establish reference data for the presence of naturally occurring radionuclides. The present study reports the probable first attempt of detailed and methodical work in the study areas for estimation of exertion attention in the recent sand beach samples.

D. Kanse(2016) (("[No Title]" n.d.; Kanse et al. 2016) Thoron exhalation from earth's face is the most important source of environmental thoron. The High Background Radiation Areas(HBRAs) of Kerala and Odisha in India have strands with beach amended with monazite, an ore of thorium, making it unique for study of thoron exhalation. In the present study, in situ dimension of thoron exhalation was carried out to collude the thoron exhalation rate over complete banks of the known HBRAs. New experimental setups for dimension of thoron face exhalation and thoron mass emission were developed and validated.

R.M. Anjos(2007) ("Website," n.d.) Natural gamma radiation measures of littoral beach deposits were used to determine the provenance of the flaxen sediments and to gain information about paleo - ocean - situations along the seacoast of three Brazilian States São Paulo(SP), Rio de Janeiro(RJ) and Espírito Santo(ES). Th/ U and Th/ K rates suggest a considerable positive correlation with the geological elaboration of the Quaternary littoral deposits of the Brazilian Southeast.

Timothy Ault(2017) ("[No Title]" n.d.) This paper reviews the frontal end of the thorium energy cycle, including the extent and variety of thorium deposits, the implicit sources of thorium product, and the physical and chemical technologies needed to insulate and purify thorium. Thorium is constantly set up within rare earth rudiments – bearing minerals that live in different types of mineral deposits, frequently in confluence with other minerals booby-trapped for their marketable value.

Pant, AmarD.(2017) ("[No Title]" n.d.; Pant et al. 2014)Monazite is one of the most important natural geological minerals due to the presence of heavy essence, rare earth and natural radioactive rudiments. Monazite is also an important ore for thorium, lanthanum, and cerium. It's veritably important to assess the attention of uranium and thorium in colorful monazite samples observed in Indian beach fronts and their relative cornucopia. In addition to thorium, vacuity of uranium in monazite is also of interest because of an alternate source for the uranium energy cycle operation going on in our country.

JohnA.S. Adams(1958) (Adams and Weaver 1958) The thorium- to- uranium rates in sedimentary jewels range from lower than0.02 to further than 21. rates in numerous oxidized international deposits are above 7, whereas utmost marine deposits have rates much below 7. Therefore, the thorium- to- uranium rate varies with sedimentary processing and depositional terrain. A cyclothem and several other sedimentary sequences illustrate the use of this rate to distinguish surroundings and processes. The thorium content of shales varies much lower than the uranium content.

BradleyS.Van Gosen(2016) ("Thorium as a Nuclear Fuel" 2016) Thorium- grounded nuclear power, despite several decades of exploration and development, has yet to be completely capitalized . In recent times, renewed interest in the implicit advantages of thorium- grounded nuclear power has prodded exploration and development on several generalities for advanced reactors using thorium energies, including high- temperature gas- cooled reactors, molten swab reactors, Canada Deuterium Uranium- type reactors, advanced heavy water reactors, fast breeder reactors, and pressurized heavy water reactors.

Petrache,(2005) (Petrache et al. 2005)This primary study describes a metallurgical process that will prize, recover and produce REE oxides from sand beaches attained from Ombo, San Vicente, northern Palawan. The sand beach contains REE minerals of allanite and small quantities of monazite. Allanite is a sorosilicate mineral containing rare worlds, thorium and uranium. Monazite is the anhydrous phosphate of cerium and the lanthanum group of rare worlds with thorium generally present in relief for cerium and lanthanum.

Beena Sunilkumar(2022) (Sunil Kumar et al. 2021) A simple hindrance free extractive bullet fluorimetric system of determining uranium in monazite mineral samples has been developed. The quenching of luminescence of uranium by thorium and the extent of quenching was studied. A bullet fluorimetric system of uranium determination was carried out using detergent birth separation of uranium to ethyl acetate in the presence of a sodium swab of ethylene diamine tetra acetic acid(Na- EDTA). The optimum attention EDTA and the effect of EDTA on uranium luminescence were studied. The delicacy of the system was established by assaying a synthetic sample and certified reference accouterments (IGS- 36 and DH- 1a).

Elaine GMurray(1958) ("Thorium, Uranium and Potassium in Some Sandstones" 1958) Thorium, uranium, and potassium attention have been determined in nineteen beach and sandstones by γ- shaft spectrometry, fluorometric uranium analysis, and α- counting. The samples were named so that both common and extreme thorium and uranium rates would be represented.

Sujata Dabolkar(2017) (Dabholkar and Kamath 2017) This work was inspired by a recent report by Bell et al., 2015 who studied potentially biogenic carbon saved in a4.1 billion- time-old Zircon and demanded to assess the eventuality of Rocks set up in Goa. Rocks(ZrSiO4) are naturally silicate minerals which show radioactivity and high rigidity and contain traces of Thorium and Uranium useful in Uranium – Thorium/ Thorium-230 courting ways. Rocks can be set up in igneous, metamorphic jewels, sedimentary deposits and as a detrital mineral in swash and sand beaches.

METHODOLOGY

For the purpose of the study empirical research is used. It helps to understand the behavior of an individual, group or a society. Convenient sampling method is used in this study for collecting the samples.Samples are collected based on the ease of availability of respondents. 200 samples-sample size. Independent variables are age, gender, educational qualification, occupation. Dependent variables are thorium as nuclear fuel, beach sand minerals,renewable resources. Pie Chart and Bar Graphs are used as research tools.

ANALYSIS

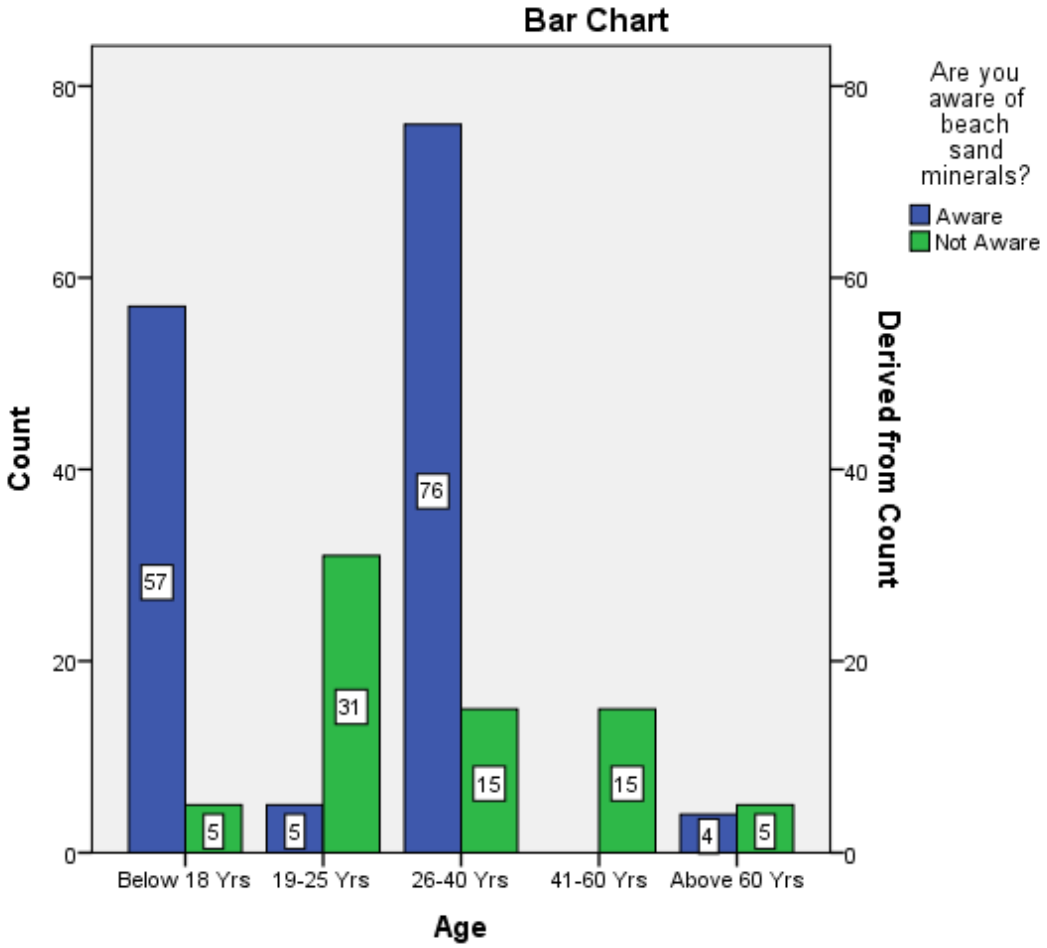

FIGURE: 1

LEGEND: Figure 1 shows the awareness about the beach the minerals

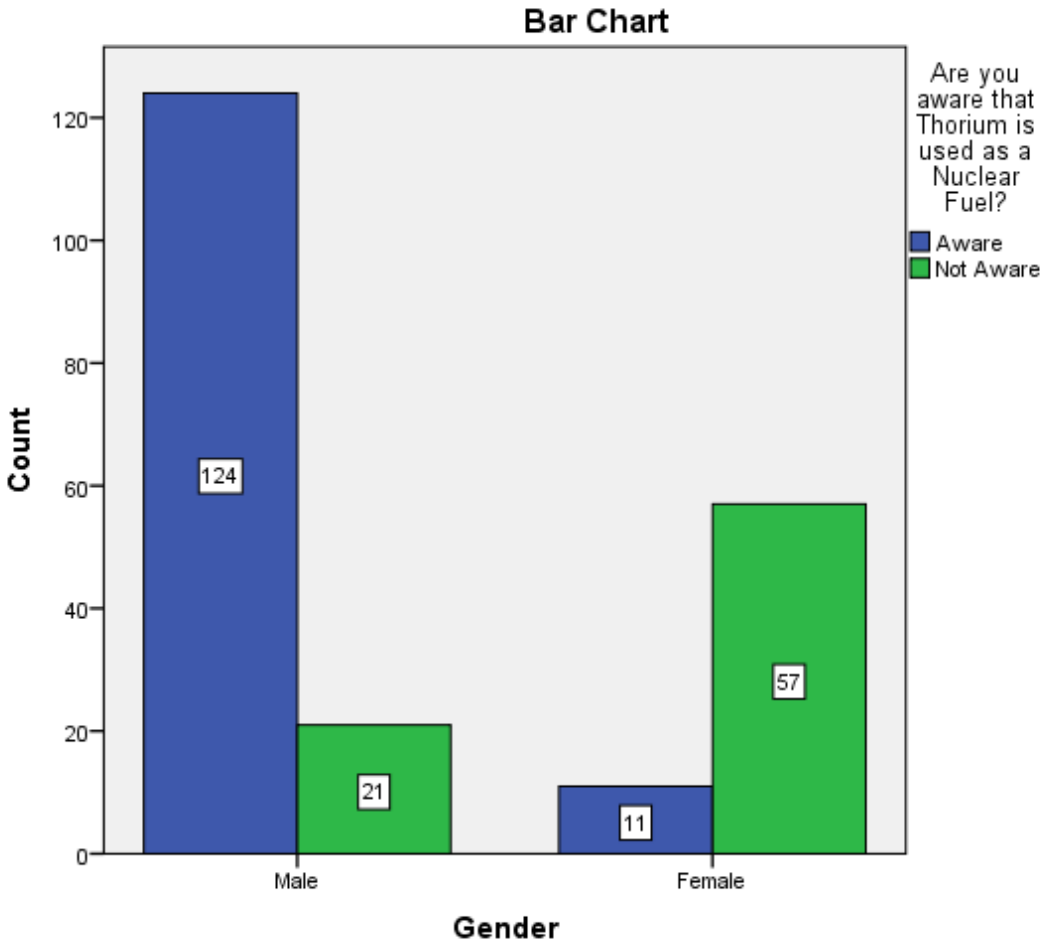

FIGURE: 2

LEGEND: Figure 2 shows the thorium is used as a nuclear fuel.

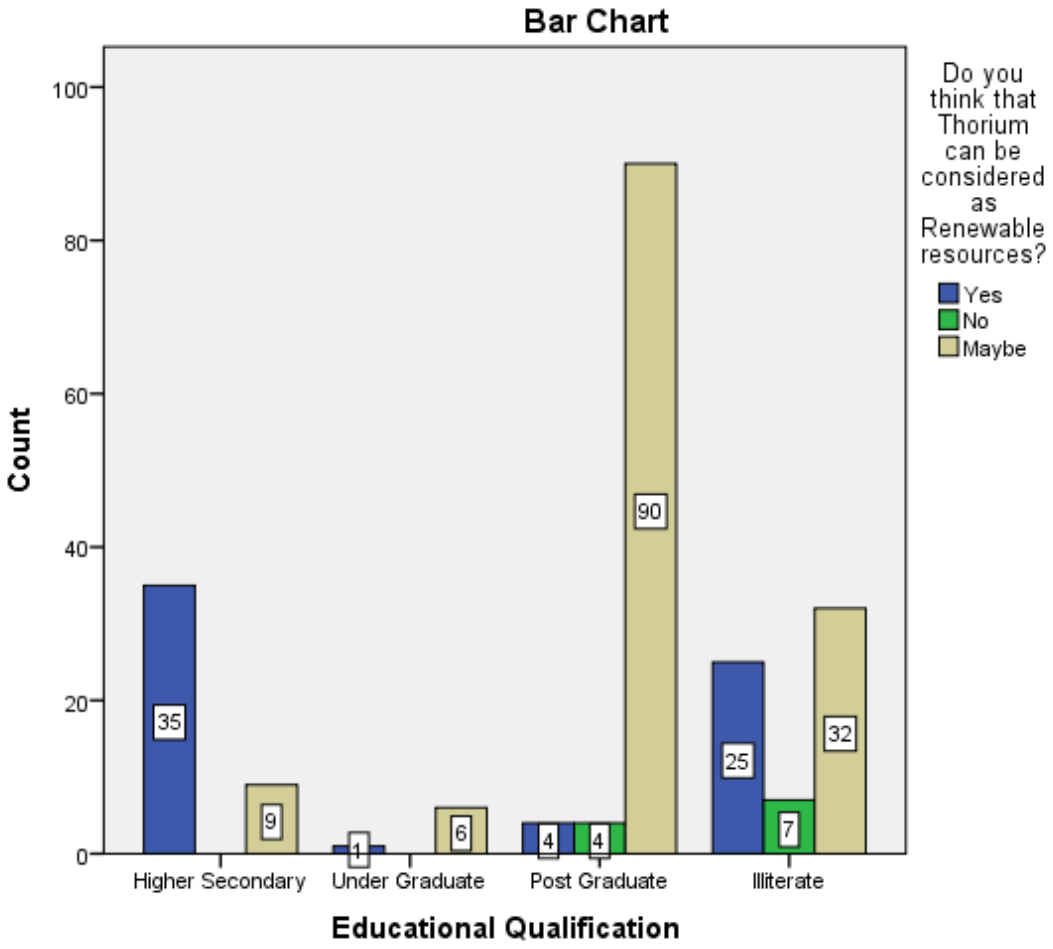

FIGURE: 3

LEGEND: Figure 3 shows the Thorium can be considered as renewable resources

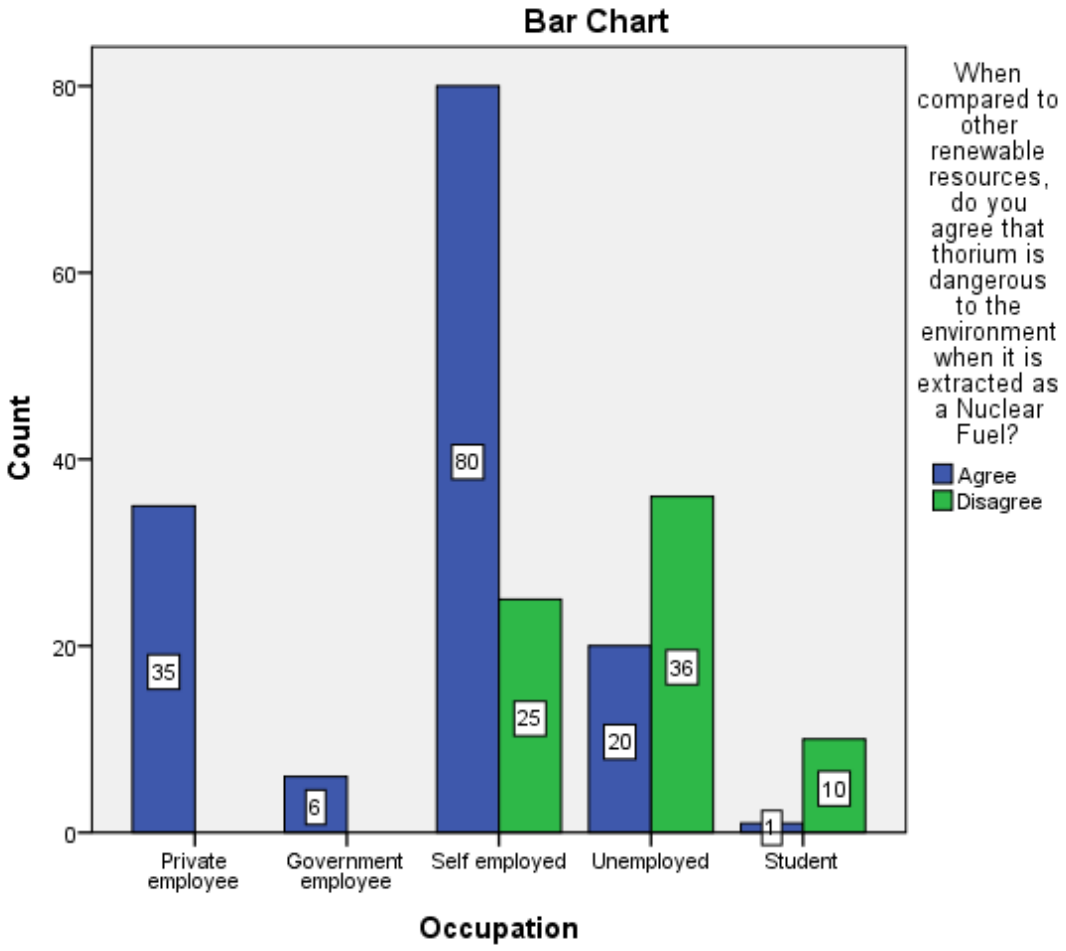

FIGURE: 4

LEGEND: Figure 4 shows the thorium is dangerous to the environment when it is extracted as a Nuclear Fuel

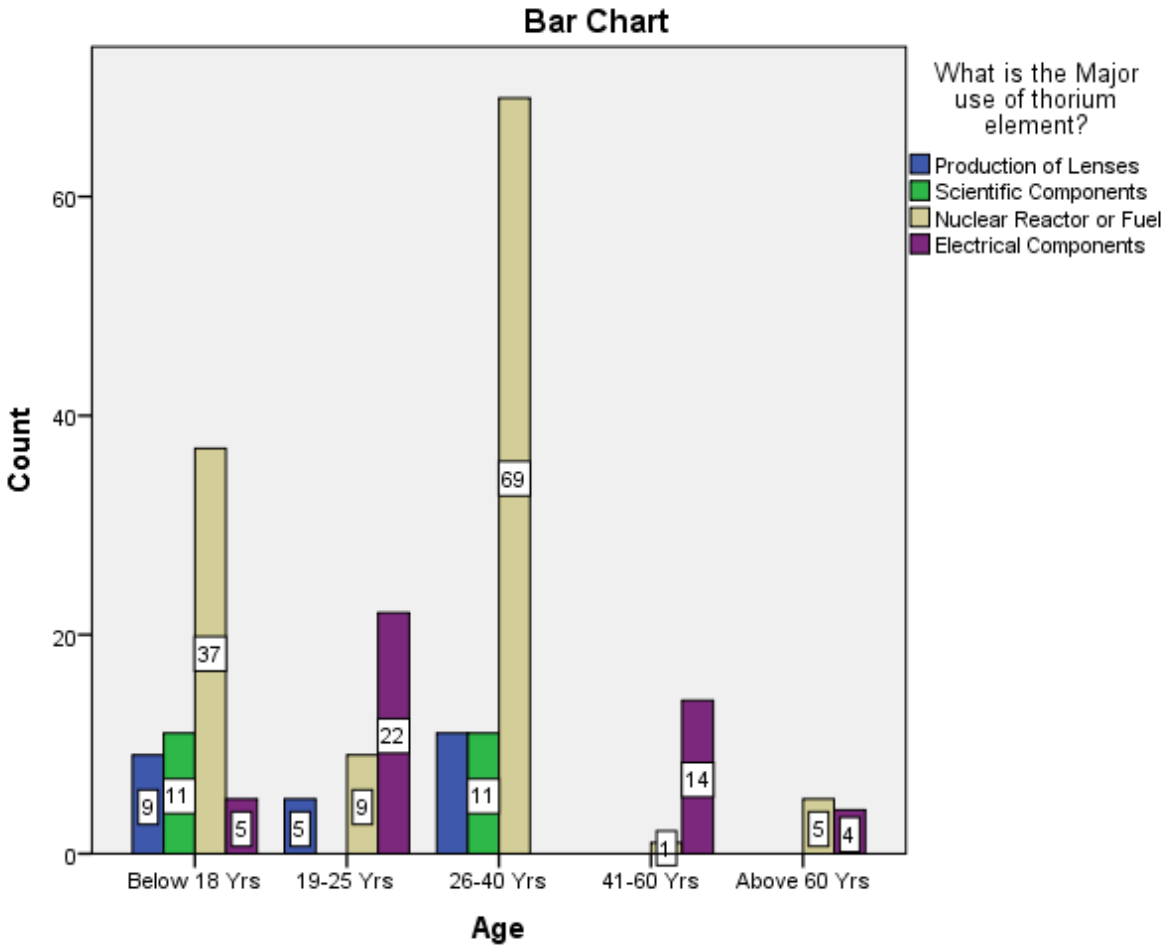

FIGURE: 5

LEGEND: Figure 5 shows the Major use of thorium element.

RESULTS

From **figure 1** it is found out that the public is mostly aware of beach sand minerals. From **figure 2** it is found out that the public is mostly aware of the fact that thorium is used as a nuclear fuel. From **figure 3** it is found out that post graduate respondents are saying that thorium can be a renewable resource. From figure **4** it is found out that the public mostly agrees with the statement "compared to other renewable resources thorium is dangerous to the environment when it is extracted as nuclear fuel. Thorium can be used as nuclear fuel. Extraction as nuclear fuel is not a dangerous thing to the environment. From **figure 5** it is found out that according to the public thorium is majorly used as nuclear reactors or for fuel.

DISCUSSION

From the responses, generally it is seen that the public are not aware about the beach sand minerals such as thorium and other elements. The origin of the thorium deposits on the West Coast of India isn't well established though a number of studies on the colorful aspects of these deposits have been carried out for more than 50 times. Thorium can be used as nuclear fuel. Extraction as nuclear fuel is not a dangerous thing to the environment.

Thorium is a non-renewable resource. The availability of thorium in the beach sand minerals is more extracted in Kerala Coastal region

LIMITATIONS

- The restrictive sample size of 200 was the limitation to the study
- The major limitation of my study is the sample frame. The sample frame is an online survey method that the respondents are aware of beach sand minerals

CONCLUSION

In Kerala and Orissa, the beach contains monazite, ilmenite, baguette, rutile, garnet and sillimanite. Mining and product of these minerals was reserved for the public sector but in 1998 policy changed to allow picky entry of the private sector. Now, Private enterprises can prize and sell rare ores similar to garnet and ilmenite from these beaches but they can not reuse or vend radioactive monazite leaves. They ’ve to store it at their own cost or fill it back in the mines. The strands of Kerala and Orissa, hold 70% of India's estimated monazite reserve of 18 million tonnes. The Department of Atomic Energy wants the Government to amend this policy- with a new provision that Private enterprises should hand over these monazite leaves to Indian Rare Earths(IREL) – which will also reuse it and try to prize thorium. And this thorium can be also used as energy in the Nuclear reactors. A 300 MW nuke- reactor requires 50 tonnes of energy in its core originally and about 5 tonnes later each time. Given the quantum of thorium rich beaches we ’ve in Kerala and Orissa, we can give nonstop force of energy to our nuke- reactors numerous times. The origin of the thorium deposits on the West Coast of India isn't well established though a number of studies on the colorful aspects of these deposits have been carried out for more than 50 times. The deposits are believed to be washed down from mounds through water aqueducts. It's proposed that snippet rates of colorful radioactive and stable products in the uranium and thorium series as a function of time could be effectively used for the purpose.

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