ISSN 2320-3862
JMPS 2016; 4(4): 47-53

Received: 20-05-2016
Accepted: 22-06-2016

Anoop Singh Gaharwar
Environmental Officer Jaypee Sidhi Cement Plant JP Vihar, Sidhi, M.P.

Naveen Gaurav
Department of Biotechnology, S GRRPG College Dehradun, U.K.

AP Singh
Department of Botany Govt. P.G. Science College, Rewa, M.P.

Hira Singh Gariya
Department of Biotechnology, S GRRPG College Dehradun, U.K.

Bhoora
Department of Biotechnology, S GRRPG College Dehradun, U.K.

Correspondence
Anoop Singh Gaharwar
Environmental Officer Jaypee Sidhi Cement Plant JP Vihar, Sidhi, M.P.

A Review Article on Manufacturing Process of Cement, Environmental Attributes, Topography and Climatological Data Station: IMD, Sidhi M.P.

Anoop Singh Gaharwar, Naveen Gaurav, AP Singh, Hira Singh Gariya, Bhoora

Abstract
Cement is the basic material for buildings and civil engineering constructions. Portland cement, the most widely used cement in concrete construction, was patented in 1824. Cement is a fine powdery material untwining silicates of calcium, formed out of raw materials consisting calcium oxide, silica, aluminum oxide and iron oxide. India has an installed capacity of 234 million tons per year, making this is the second highest Cement producer in the whole world. As is the case in the United States, several multinational Cement producers have built up a larger share of India's Cement production industry. Among many countries India is the second highest producer of cement in the world, with 130 large cement plants and an installed capacity of 234 million ton per annum (94% of which is from large cement plants). During 2006-2007 cement production grew at a rate of 9.1% compared to the same period the previous year. However, despite this growth, India's per capita production is 115 kg per annum, well under the world average of 250 kg (World Cement 2007). The Cement manufacturing sector plays a vital role in the nation's economic development since cement is the most versatile and widely used construction material. The cement industry has made phenomenal progress in terms of volume, technology and product up gradation in recent years.

Keywords: Cement, civil engineering, concrete construction, calcium oxide, silica, aluminum oxide, iron oxide, up gradation etc.

1. Introduction

The current plan recommends infrastructure spending of around £37 billion annually for the next five years. By 2010, a total of 20-30 million household units and 100,000 hotel rooms will be needed while 55 million ft2 of office space and 350 new shopping malls and multiplexes will be constructed; 04 million jobs in some 235 Special Economic Zones are being created involving a spending of £35 billion. In other areas of spending, the statistics are quite simply mind blowing. For example, about 68000 km of National Highway and 2000 km of Expressway are either underway or planned for development. Private investment is being sought for new airport and the design of 07 green field airport, while 50 projects, valued at £6.5 billion are in the pipeline for increasing the capacities of 12 major ports. In the power sectors, an estimated £106 billion in required for developing 72,000 MW of extra capacity (Maxwell-Cook, 2007) [11].

Table 1.1: General information about cement plants in India (Source-CMA, May-2011)

S. No.	Particulars(as of March, 2011)	Data
	Large Cement Plant	
1	Total Number of Cement Plants	139
2	Installed annual capacity	234.30 Mn.T
3	Cement production	168.29 Mn.T
4	Manpower employed	1.20 lakhs approx.
5	Turnover	18000(Mn.US $) approx.
	Mini Cement Plant	
1	Cement plant	365 nos. approx.
2	Installed capacity	11 Million Ton
3	Production of Cement	6 Million Ton

Cement Manufacturing

Cement manufacturing uses energy to process raw materials consisting of mainly limestone (calcium carbonate, $CaCO_3$), clay (aluminum silicates), sand (silica oxide), and iron ore to produce clinker, which is ground with gypsum, limestone, etc to produce cement.

After an initial preblending stage, the raw materials are mixed together and ground to form a homogeneous blend with the required chemical composition (the raw meal). The fineness and particle size distribution of the raw meal are important characteristics for the burning process. Following mixing, the production process continues in a rotary kiln by calcining the raw meal (e.g. decomposing $CaCO_3$ at about 900 °C), releasing carbon dioxide (CO_2) and leaving CaO. This is followed by the clinkering process, in which CaO reacts at a high temperature (1,400 °C to 1,500 °C) with silica, alumina, and ferrous oxides. Other constituents may be added in the raw material mix to meet the required composition (e.g. silica sand, foundry sand, iron oxide, alumina residues, blast furnace slag, and gypsum residues). The temperature of the flame and produced gases is close to 2,000 °C. The hot clinker falls from the kiln onto the cooler, where it must be cooled as quickly as possible to improve the clinker quality and to recover energy by heating secondary air. Grate coolers are typically employed for this purpose (as opposed to the use of satellite coolers). The cooled clinker is then ground with gypsum and limestone to produce portland cement and ground with other additional constituents to produce composite or blended cements. Cement is then stored in silos or bags. The blending constituents are materials with hydraulic properties (e.g. natural pozzolane, fly ash, blast furnace slag, and occasionally bottom ash). In fly and bottom ashes, carbon residues (typically from coal-fired power plants) should not be present. $CaCO_3$ is sometimes added in small quantities as filler.

Calcium is found in limestone, which is one of the most common natural resources in the world. Limestone is usually quarried in the vicinity of cement factories, where it is extracted through blasting techniques. Step by step, these blasted stones are crushed to gravel before they are transported to the cement factory and mixed with the two other basic ingredients of cement, clay and sand.

At that point, there are two different manufacturing processes, the dry and wet process. In the dry process, the raw materials are ground, mixed and fed into a cement kiln, a horizontal rotating cylinder. In the wet process, water is added to the raw materials before being fed into the kiln, to create slurry. The dry process is more environmentally friendly and emits less CO_2, due to the additional use of fuel needed in the wet process.

The cement kiln is heated to a temperature of approximately 1450°C, and uses a variety of fuels, ranging from coal and biomass to waste materials such as old rubber tires. Only at these high temperatures do the chemical and physical characteristics of the raw materials change. These changes create so-called 'Clinker' that come out of the kiln in small marble size pieces. After cooling, these clinkers are further ground to create Portland cement.

Contents of Portland cement

Cement is a mixture of Calcium oxide(CaO)(62.66%), Silicon oxide(SiO_2)(19-22%), Aluminum tri-oxide(Al_2O_3)(4-8%), Ferric oxide(Fe_2O_3)(2-5%), Magnesium oxide(MgO)(1-2%) and also Selenium, Thallium and other impurities.

Types of cement

The cement industry has been producing a range of six main varieties of cement like PSC (Portland Blast Furnace Slag Cement), SRC (Sulphate Resisting Cement), PPC (Portland Pozzolana Cement), OPC(Ordinary Portland Cement) Oil Well Cement and White Cement, besides 53S-43S(earlier IRS-T40) for railway sleepers. Cement produced in India compulsorily conforms to Indian Standards specification issued by the Bureau of Indian Standards(BIS).These are five certified types of cement- Portland Cement, Portland blast furnance Cement, Sulphate-resisting Portland Cement, Masonry Cement and Portland pulverized fuel ash Cement (BIS, 2005).

Types of Cement Process

The cement manufacturing process involves mining, crushing, grinding of raw materials (principally limestone and clay), blending of raw meal, calcining the materials in a rotary kiln, cooling the resulting clinker, mixing the clinker with gypsum, and milling, storing, and bagging the finished cement.

The raw materials used to make cement may be divided into four basic components: lime (calcareous), silica (siliceous), alumina (argillaceous), and iron (ferriferous). Approximately 1450 kilograms (kg) of dry raw materials are required to produce one tonne of cement. Approximately 35% of the raw material weight is removed as carbon dioxide (CO_2) and water vapour.

The basic chemistry of cement manufacturing process begins with the decomposition of clay minerals into SiO_2 and Al_2O_3 on the one hand, and of calcium carbonate ($CaCO_3$) at about 900 °C to leave calcium oxide (CaO, lime) liberating CO_2, on the other hand. The latter process is known as calcination. This is followed by the clinkering process, in which the CaO reacts at high temperature (typically 1450 °C) with silica, alumina, and ferrous oxide to form the silicates, aluminates, and ferrites of calcium. The resultant clinker is then ground together with gypsum and other additives to produce cement.

Naturally occurring calcarrous deposits such as limestone, marl or chalk provide calcium carbonate (C_aCO_3) and extracted from quarries, often located close to the cement plants. Very small amounts of "corrective" additives such as re ores or clay can be required to compensate Fe_2O_3, Al_2O_3 & SiO_2 to ensure chemical composition.

Raw limestone is transported to crushers for breaching down into smaller pieces. Mixing of different raw materials in fixed proportion to attain specific chemical composition and the crushed pieces are then milled together to produce "raw meal" the quality of cement depends on the chemistry of raw meal, which is monitored & controlled carefully.

A pre heater is series of vertical mounted cyclone from where feed is passed coming into contact with wet gases moving anti-directional swirling hot kiln exhaust gases moving in the opposite direction. In these cyclones, thermal energy is recovered from the hot flue gases and the raw meal is preheated before it enters the kiln, so the necessary chemical reaction occurs faster and more efficiently.

The precalciner meal then enters the kiln. Fuel is fired directly into the kiln to reach temperature of up to 1450 ^{0}C as the kiln rotates, at 3-5 RPM, times per minute, the meal slides & vemes in hotter zone at other and the vigorous heat account to various physical & chemical reactions producting clinker as product.

Stored clinker is mixed with gypsum & grounded into grey power. Earlier, inj cement mills; ball mills have been used as drinding media, but in modern days efficient technology. The final product is homogenized and stored in cement silos and dispatched from there to packing plant for getting packed.

Study Area: Geological Location
M/s Jaypee Sidhi Cement Plant is located at Majhigawan village, in Rampur Naikin tehsil of Sidhi District of M.P. The cement plants falls at the intersection of Latitude $24^0$19' 35" North and Longitude 81^0 19' 08" East and at an elevation of about 325m above mean sea level (MSL).The present study of assessing environmental impacts is focused on the Jaypee Sidhi Cement Plant,Distt-Sidhi (M.P.)

National Park/Sanctuary
The Son Gharial sanctuary is located at about 9.0 km from the cement plant boundary, which is primarily situated in the Sidhi district of the Central India in MP, with very small portions extending to the Satna and Shahdol district. The lengthwise breakup of the sanctuary is Son 160.93 km, Gopad 25.75 km and Banas 22.53. To the 200 meters on each side of these lengths of the rivers. As per the observations of the study the middle part of the river there is a rocky stretch interrupted by sand. Both the banks of the river are not sloppy. Hence stretch is not preferred site for larger aquatic animals. Therefore no gharials observed in the study area.
Govindgarh reserve forest is 0.2 km north-northeast directions 10 km radius study area. But there are no ecologically sensitive areas like wildlife sanctuaries within 10 km radius from the plant and also no migration route to avi fauna are observed or recorded in the study area. Sone gharihal sanctuary is located at a distance of 9.0 kms towards south east direction, similarly as per the forest department, no endangered or rare species of flora and fauna are reported or observed in the study area.

Environmental Attributes & Topography
Various environmental parameters such as- geology of the study area, hydrogeology, geology, metrology, hydrology, geology, meteorology, soil quality, natural vegetation, wild life, climate, rainfall, temperature, humidity, wind speed and direction were studied to understand the environmental setting of the study area.

Hydrogeology
There are three hydro geological units existing in the area namely, alluvium, sandstone associated with shales and limestone. The groundwater occurs under water table conditions in all these three formations and is transmitted through the fractures, joints, bedding planes of the hard rock and granular zone in alluvium. The limestone is hard and finely grained and impervious in nature having no primary porosity. The only porosity present is developed due to secondary opening and is referred to as secondary porosity or fractured porosity. The secondary porosity decrease with depth due to weight of overlying rocks. The sandstone forms a very poor aquifer yielding limited quantity of water in the southern part of the area. The Kaimur hill ranges which mainly consist of sandstone and associated rocks acts as a water divide in the area. The depth to water level within the said area ranges between 7 to 8 m below ground level.

Geology
The geology of the area is mainly composed of thin alluvial cover, belonging to Sub-Recent to Recent period of Quaternary Period followed by Kaimur sandstones/ quartzite of Upper Vindhyans of Proterozoic Era. Kaimur sandstones/ quartzite limestones of Rohtas formation of Semri Series of Lower Vindhyans of Proterozoic Era. Limestone is generally dark grey in colour and fine grained in nature. Generalized stratigraphy is as follows:

Age	Super Group	Group	Rock types
Quaternary			Sand, silt, clays, kankar
Proterozoic	Vindhyan	Kaimur (Upper Vindhyan)	Upper Kaimur Sandstone
			Bijaigarh Shales
			Lower Kaimur Sandstone
		Unconformity	
		Semri (Lower Vindhyan)	Rohtas Formation:
			Suket Shales
			Nimbahera Limestone & Shale
			Conglomerate & Sandstone

The rocks in Majhgawan mining lease area belongs to Rohtas Stage of Semri Series of Lower Vindhyan System of Indian Stratigraphy. It is overlain by Ghaghar Quartzite that forms a part of the Kaimur Series of Upper Vindhyan System and is underlain by Glauconite Bed of Son Valley Region.
The regional strike of the rocks of the deposit is EastNorthEast – West South-West with a northerly dip varying from 10^0 to 15^0. The Rothas Stage consists of mainly limestone and shale which are comparatively less resistant to weathering and hence occur as valley / almost flat land near to Kaimur Hill which consists of mainly sandstone / quartzite. As sandstone is resistant to weathering, sandstones of Kaimur Series occur as hills. Rocks of Kaimur Series again overlain by Rewa Series (consisting of mainly sandstone) and ultimately by Bhander Series.
Soil: It has been observed that the texture of soil is mostly clay in the mining area. Soil profile was studied to know the physical characteristics of soil in and around the mining area. It was observed that soil broadly consists of sand 19%, silt 35% and clay 46%.
Climate: The nearest observatory is located at Sidhi which is about 50 kms from the site. Based on Koppen classification of climatic pattern, the mining area may be classified as tropical steppe, semi-arid and hot. The year is divided in to four seasons. The winter season is from mid-December to February and is followed by the hot summer season from March to mid-July, including the pre-monsoon season from April to June. The period from mid July to mid-September constitutes the southwest monsoon season and the period from the later half of September to mid-December as post monsoon season.
Meteorology: The micro-meteorological data within the study

area during the air quality study period is an indispensable part of air pollution studies. Data was collected from the IMD-Sidhi, which is the nearest IMD station to the study site. The data collected from IMD includes wind speed, wind direction (recorded in sixteen directions), temperature, relative humidity, atmospheric pressure, rainfall over a period of last two years. The monthly maximum, minimum and average value was recorded for all the relative parameters except wind speed and direction.

Temperature: The period from April to June is marked by continuous increase in the temperature. May is the hottest month of the year with a mean daily maximum & minimum temperature (in May) of 42.1 ^{0}C to 26.9 ^{0}C respectively. With the onset of south-west monsoon by about mid-June, the temperatures go down considerably. From November onwards, both the day and night temperature decrease and December is the coldest month, with daily daily maximum & minimum temperature of 25.8 ^{0}C to 8.4 ^{0}C.

Table 1.2: Climatological data station: IMD, Sidhi (Mean of 10 years data)

Month-2010	**Atmospheric Pressure (mb)**		**Temperature (^{0}C)**		**Relative Humidity (%)**	
	17:30 PM	**08:30 AM**	**Mean Min.**	**Mean Max.**	**17:30 PM**	**08:30 AM**
January 2010	982.10	985.40	9.50	32.40	42	73
February 2010	980.00	983.40	11.00	31.20	36	67
March 2010	977.00	981.00	15.60	39.60	28	47
April 2010	972.80	977.00	22.70	43.70	20	38
May 2010	968.40	972.80	27.20	44.90	38	51
June 2010	965.40	969.00	26.90	41.00	59	70
July 2010	965.70	968.50	25.50	37.80	77	82
August 2010	967.20	969.90	25.70	36.00	72	80
September 2010	971.00	974.20	23.80	35.60	75	84
October 2010	978.30	981.20	21.20	37.10	45	69
November 2010	981.20	983.60	14.80	33.90	52	66
December 2010	983.50	986.30	8.50	28.30	50	67

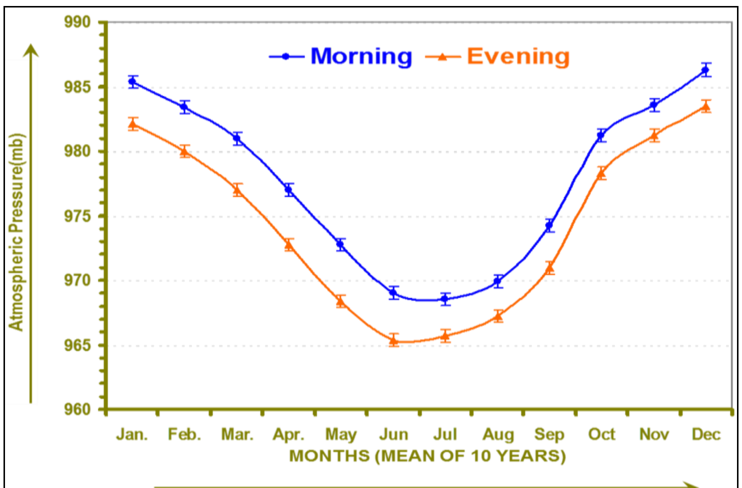

Fig. 1.2a Line diagram of Atmospheric Pressure(mb) mean of 10 years

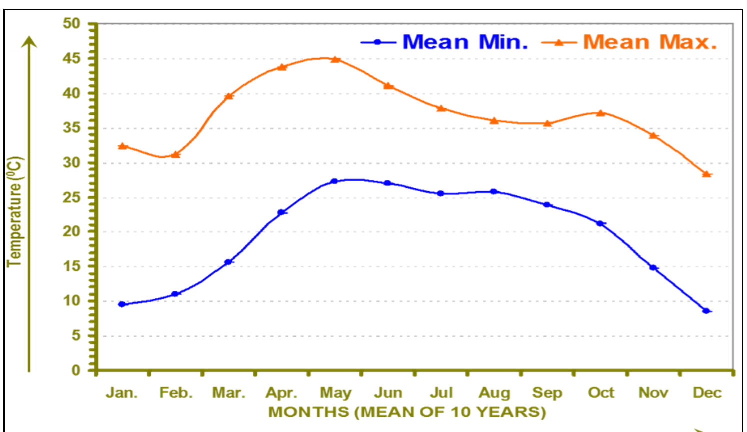

Fig. 1.2b Line diagram of Temperature (^{0}C) mean of 10 years

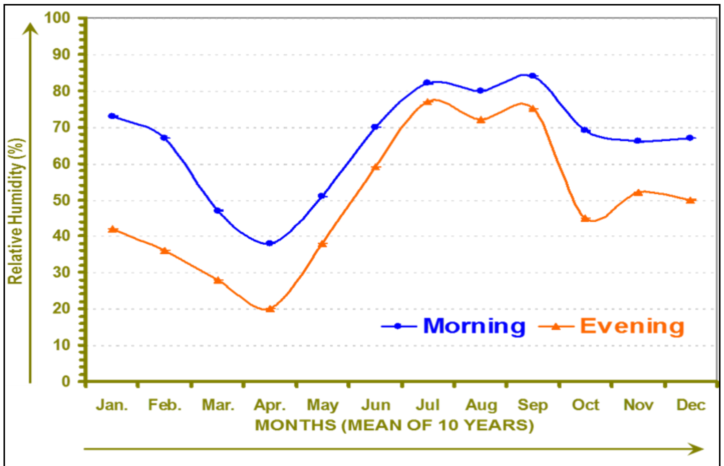

Fig. 1.2c Line diagram of Humidity (%) mean of 10 years

Humidity

Relative humidity during the southwest monsoon is generally over 85%, in the morning and 79% in the evening during August. During the rest of the year, air is normally dry. Relative humidity was observed in the range between 21% & 85% with the mean value from 47% of 62%.

Rainfall

The average annual rainfall in the region is 1016.83 mm as per IMD data of Sidhi. Any changes in the pattern of rainfall will be on regional scale because of cumulative reasons.

Table 1.3: Rain fall recorded in mm at Rampur Naikin tehsil headquarter, district Sidhi (Year: 1998 to 2012)

Year	Rainfall	Year	Rainfall
1998-1999	0922.3	2005-2006	0982.2
1999-2000	1182.4	2006-2007	1014.7
2000-2001	1093.2	2007-2008	0661.2
2001-2002	1246.8	2008-2009	0771.3
2002-2003	0842.7	2009-2010	1010.7
2003-2004	1397.7	2010-2011	1011.1
2004-2005	0864.8	2011- 2012	1234.6
Average annual rainfall (mm)			**1016.83**

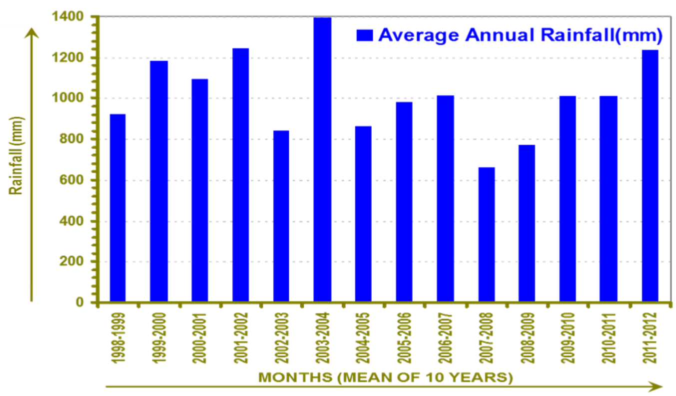

Fig. 1.3 Bar diagram of Rainfall (mm)

Winds

The winds blow from West to East during March to September from S-SW-W during morning hours from NW-NE during day time and from East-North during evening hours from October to February. During monsoon the maximum wind velocity sometimes reaches 45-50 kmph. The predominant wind direction during study period are W, N & NW. Winds are generally light to moderate except during June when it is maximum with 9.2 kmph. The mean annual is 5.4 kmph while it is minimum 2.7 kmph during November.

Winds are generally light to moderate, except during the south-west monsoon season, when these are moderate to strong. From May to September, the predominant wind direction is from North-West to South-East. In the post monsoon and winter months, the wind flows mainly between north-east and north-west directions. Mean wind speed is highest in June and lowest in November and December.

Wind Speed/Direction

The wind roses for the study period representing winter, pre-monsoon, monsoon and post-monsoon seasons along with annual wind rose are given below.

Site Wind Rose-Pre Monsoon Season-2010

Time 8:30 am of predominantly winds were from W direction for 16.7% of the total. The second predominant wind direction was from E direction (4.3%). In the N direction, the winds recorded for 1.0% of the total. In other directions, the % frequencies observed as ESE(0.0%), SW(1.0%), SSW(0.0%), ENE(0.0%), WNW(0.0%), SE(0.0%), NNE(0.0%), NNW(0.0%), WSW(0.0%), NE(0.0%), SSE(0.0%), NW(0.0%) and Calm conditions prevailed for 75.6% of the time.

Site Wind Rose-Post Monsoon Season-2010

Predominantly winds were from W direction for 13.3% of the total time. The second predominant wind direction was from N direction (6.3%). In the ESE direction, the winds were observed for 6.2 percentage of the total time. In other direction, the % frequencies observed as E(5.1%), NNW(5.0%), WSW(4.5%), SW(4.1%), WNW(3.8%), SSW(3.6%), SE(2.9%), NW(2.7%), ENE(1.9%), NNE(1.6%), SSE(1.6%), S(1.3%) and NE(1.1%). Calm conditions prevailed for 35.4% of the time.

Site Wind Rose-Winter Season-2010-2011

Time 8:30 AM of predominantly winds were from W direction for 4.5% of the total time. The second predominant wind direction was from E direction (2.2%). In the WNW direction, no winds were observed for the all time. In other directions, the % frequencies observed as ENE(0.0%), N(0.3%), S(0.0%),

SW(0.0%), SSW(0.0%), NNE(0.0%), NNW(0.0%), WSW(0.0%), NE(0.0%), ESE(0.0%), SSE(0.0%), NW(0.0%), and Calm conditions prevailed for 93.0% of the time.

Wind Speed/Direction

The wind roses for the study period representing winter, pre-monsoon, monsoon and post-monsoon seasons along with annual wind rose are shown

Site Wind Rose-Pre Monsoon Season-2011

Predominantly winds were from W direction for 24.1% of the total. The second predominant wind direction was from E direction (6.9%). In the N direction, the winds were seen for 4.1 percentage of the total. In other directions, the % frequencies observed as ESE(3.5%), SW(3.1%), SSW(2.4%), ENE(2.1%), WNW(1.9%), SE(1.9%), NNE(1.6%), NNW(1.5%), WSW(1.4%), NE(1.3%), SSE(1.1%), NW(1.0%) and Calm conditions prevailed for 41.2% of the time.

Site Wind Rose-Post Monsoon Season-2011

Predominantly winds were from W direction for 7.2% of the total. The second predominant wind direction was from E direction (3.2%). In the NNW direction, the winds were seen for 2.5 percentage of the total time. In different other directions, the % frequencies observed as E(2.3%), ENE & ESE(1.8%), WSW(1.4%), NW(1.3%), SSE(1.2%), SW(1.1%), SE(1.0%), WNW(0.9%), SSW(0.8%), NNE(0.6%), NE(0.4%), S(0.3%) and Calm conditions prevailed for 72.2% of the time.

Site Wind Rose-Winter Season-2011

Predominantly winds were from W direction for 14.2% of the total time. The second predominant wind direction was from E direction (6.4%). In the WNW direction, the winds were seen for 3.6 % of the total time. In different other directions, the % frequencies observed as ENE(3.1%), N(2.7%), S(1.7%), SW(1.4%), SSW&NNE(0.9%), NNW(0.7%), WSW(0.6%), NE(0.4%), ESE(0.3%), SSE&NW(0.2%), and Calm conditions prevailed for 62.7% of the time.

Table 1.4: Summary of Wind Pattern – IMD Sidhi

Season	First predominant winds		Second predominant winds		Calm Condition in %	
	08:30 AM	17:30 PM	08:30 AM	17:30 PM	08:30 AM	17:30 PM
Winter	West(4.5)	West(10.7)	East(2.2)	East(3.3)	93.0	80.0
Pre-Monsoon	West(16.7)	West(47.3)	East(4.3)	East(6.4)	75.6	35.3
Monsoon	West(29.2)	West(25.2)	East(8.0)	East(7.5)	55.8	59.5
Post Monsoon	West(4.0)	West(4.5)	East(1.5)	East(2.5)	93.5	91.5
Annual	**West(13.6)**	**West(21.8)**	**East(4.0)**	**East(4.9)**	**79.5**	**66.6**

Note: Figures in parenthesis indicates % of time wind blows

Discussion

Lameed and Ayodele (2008) [9] conducted his research work to understand the impact of the cement industry on the biodiversity of plants and his study showed that there were no effects of cement manufacturing on biodiversity including both plants and animals.Although due to lack of rain, dehydration in plants was noticed. Some leaf spots and yellowing texture was observed in Rhizophora leaves. At last they concluded that the industrial activity of cement plant will have some impact on biodiversity.

Navia & Rivela (2006) [12] reported Life cycle assessment Alternative raw materials in the cement industry like spent volcanic soil, which present the advantage to be by products or waste from other technical systems, appear to allow the development of cement production in a more sustainable way. An overall reduction of 110 kg in the consumption of limestone per ton of clinker produced, due to the higher $CaCO_3$ content. The accomplishment of cleaner technologies in the cement industry depends on a demonstrated reduction of the emission loads with quantifiable economical benefits referred to product quality improvement, material or cost reduction (Wang, 2007) [15]. George, *et. al.*, (2007) [8] reported cement dust impact on the leaves of the affected site plants. Alejandro, *et.al.,* (2007) [1] in his the Life Cycle impact assessment (LCIA) classified major environment hindrances energy as a result of cement manufacturing and characterized and their effect on different impact categories analyzed. Various differences evaluated are originated due to changein clinker composition.

Gbadebo and Bankkole (2007) [7] reported toxic and harmful elements in the air borne cement dust. Pacifica & Ogola (2007) [13] reported that EIA (Environmental Impact Assessment) play crucial role in assessing environment issue. Zainudeen (2008) [16] reported that 4-5% dust emission is due to the kiln feed, while the other sources of dust emissions include the crushers, grinding clinker coolers and material handling equipments. The case study suggests that the major sources of CO_2 emissions are from the fuel burning and during the clinker production in kiln, which forms a part of the cement production process itself. The study found that 0.613 to of CO_2 is emitted when one ton of clinker's produced. Liu, *et.al.,* (2009) [10] reported that only in China, which is a biggest cement manufacturer in world, cement manufacturing has contributed 1788.78 million metric tons of CO_2 (carbon equivalent) into atmosphere in the past 35 years (1969-2003). He estimated that a doubling in economic growth might result in nearly doubling in CO_2 emissions. In the modern time where the global warming is a hot topic, an EIA is must for every cement company project to cut the carbon emission.

Bosch, *et.al.,* (2008) [4] proposed a life cycle assessments (LCA) method, he described that the use of waste (tires, prepared industrial waste, dried sewage sludge, blast furnace slag) led to reduced greenhouse gas emissions, decreased resource consumption, and mostly to reduced aggregated environmental impacts. Regarding the different kiln systems, the environmental impact generally increased with decreasing energy efficiency. Bashar, *et. al.,* (2009) [2] used Gaussian air pollution model and predicted concentrations of the air pollutants. Tahar, *et.al.,* (2009) [14] reported that cement industry with its atmospheric emissions of gases and dust may affect the chemical balance of the atmosphere and environment such as soil. Chen, *et.al.,* (2010) [5] reported environmental impact for cement production.

Conclusion

Metrological data was collected from the IMD-Sidhi, which is the nearest IMD station to the study site. The data collected from IMD includes wind speed, wind direction (recorded in sixteen directions), temperature, relative humidity, atmospheric pressure, rainfall over a period of last two years. The monthly maximum, minimum and average values were collected for all the parameters except wind speed and direction. The predominant wind directions during the study period are west to east and east and northwest. (Table-1.2 to 1.4).

References

1. Alejandro J, Antonio A *et.al.* Comparative analysis of the life cycle impact assessment of available cement inventories in the EU Science direct, Cement and concrete research 2007; 37:781-788.
2. Bashar M, Al Smadi, Kamel K, Al –Zboon *et al.* Assessment of air pollutants emissions from a cement plant: A case study in Jordan, Jordan journal of civil engineering. 2009, 3(3).
3. BIS. Specification for 43 grade Ordinary Portland Cement BIS 8112 (2005). Manak Bhavan New Delhi. Specification for 53 grade Ordinary Portland Cement BIS 8112 (2005). Manak Bhavan New Delhi, 2005.
4. Bosch FX, de Sanjosé S, Castellsagué X. Chapter 4 HPV and genital cancer: the essential epidemiology. Vaccines for the Prevention of Cervical Cancer, 2008; 1: med-9780199543458-chapter-4. DOI: 10.1093/med/9780199543458.003.0004.
5. Chen C, Habert G, Bouzidi Y, Jullien A. Environmental impact of cement production, detail of the different processes and cement plant variability evaluation, 2010.
7. Gbadebo M, Bankole OD. Analysis of potentially toxic metals in airborne cement dust around Sagamu, Southwestern Nigeria Asian Network for Scientific Information, Journal of Applied Science. 2007; 7(1):35-40.
8. George D, Nanos Ilias F, Ilias. Effects of inert dust on Olive (Olea europeaea L.)Leaf physiological parameters, Env. Sci Pollut Res 14(3) 212-214. Journal of Cleaner Production. 2007; 18(5):478-485.
9. Lameed GA, Ayodele AE. Environmental Impact Assessment of Cement Factory Production on Biodiversity: A Case Study of UNICEM, Calabar Nigeria. World Journal of Biological Research. 2008; 001:1-07.
10. Liu Yu YK, Ningsheng H, Zhifeng W, Cuiping W. CO_2 emission from cement manufacturing and its driving forces in China. International Journal of Environment and Pollution. 2009; 37(4):369-382.
11. Maxwell Cook P. USA World Cement 2007; 39(7):27-134.
12. Navia R, Rivela B. *et.al.,* Recycling contaminated soil as alternative raw material in cement facilities: Life cycle assessment Science direct, resources, conservation and recycling 2006; 48:339-356.
13. Pacifica F, Achieng Ogola. Environmental Impact Assessment General Procedures; UNU GTP and KenGen, at Lake Naivasha, Kenya, 2007.
14. Tahar G, Meriem A, Manel H. Chemical Characterization of the Atmospheric Dismissals of the Cement Factory and Survey of Their Impact on the Quality of Soil -Case of the Cement Factory of El Ma El-Abiod, Algeria, American-Eurasian Journal of Toxicological Sciences. 2009; 1(2):37-42.
15. Wang A. Environmental protection in China: the role of law, 2007.
16. Zainudeen N. Cement and its effect to the environment: A case study in SriLanka; School of the Built Environment, 2008, 1408-1416; 978-1-905732-36-4, http://www.irbnet.de/ daten/iconda/ CIB11336.pdf.