

Functions of Portland Cement Ingredients with Benefits and Limitations

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Abstract

Cement industry plays a fundamental role in the development and improvement of India. It is binding substance required while building something. In this paper we are discussing various types of ingredients and the ratio of these ingredients that are be used in Portland cement. In this paper we also discussing about the functionality of these ingredient.

I. INTRODUCTION

Silicate cement is an ordinary Portland cement, in which the color of concrete made from it is similar to natural rocks on the British island of Portland. For the Portland cement, the raw material consist 3 main component that is calcium oxide(approx. 60%), silicon dioxide(22%) and alumina(10%). The calcium oxide originates from limestone, while silica and alumina come from shale, clay and bauxite. The raw materials also contain iron oxide, magnesia, calcium sulfate, etc.

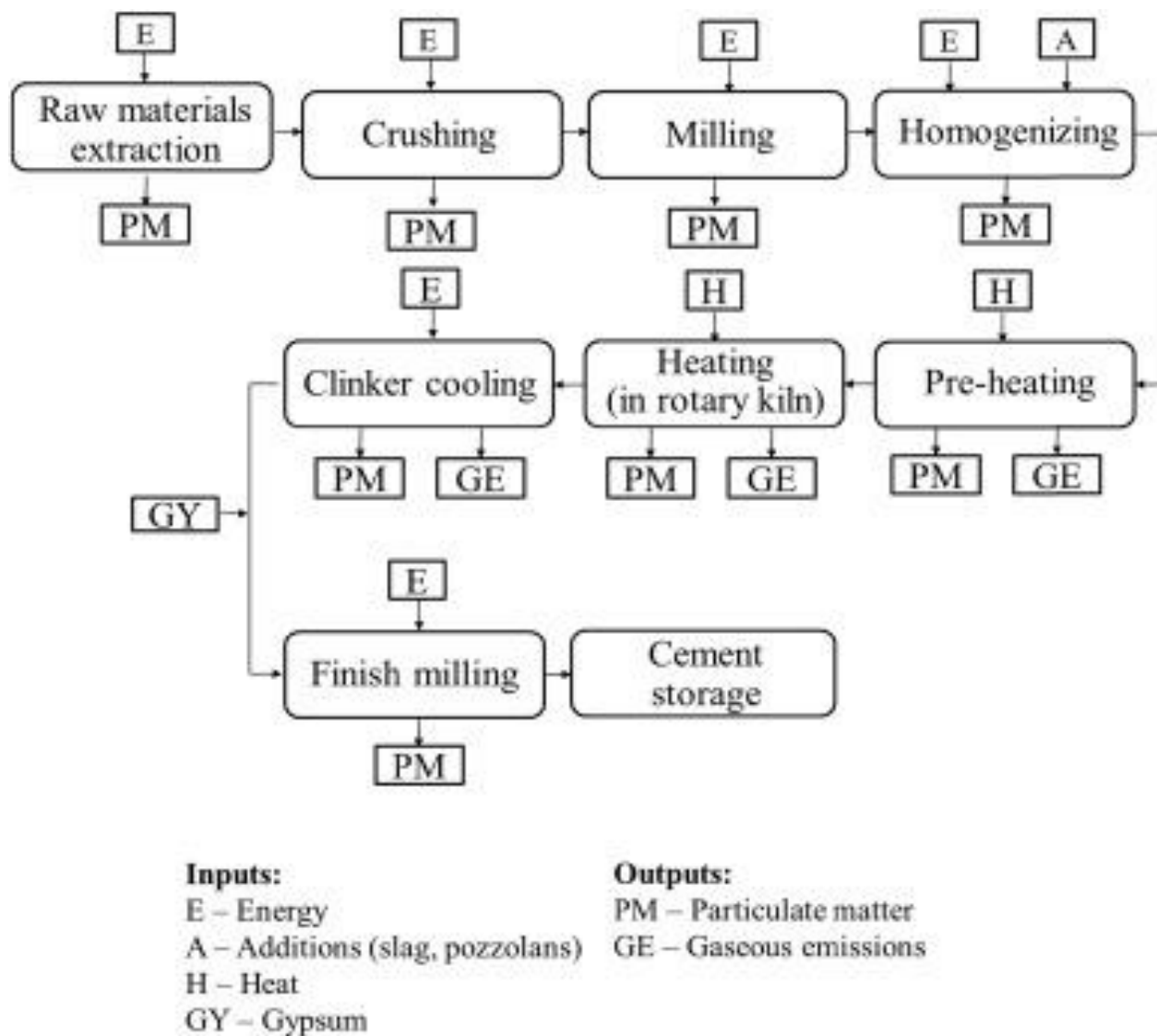


Fig 1: Portland cement

II. FUNCTIONS OF CEMENT INGREDIENTS

Every ingredient imparts various properties to the cement. The proper ratio of various ingredients of cement produces the good quality of cement

(1) Lime (CaO):

It is most significant ingredient of cement and its ratio has to wisely maintain. The cement comprises 62 to 67% of lime in it. It is acquired by limestone, chalk, shale and so on. The suitable amount of lime in cement forms the silicates and aluminates of calcium. The deficiency

of lime decreases the strength of cement also decreases the setting time of cement and excess quantity of lime in cement becomes unreliable as well as development and crumbling of cement.

TABLE 1:

RANGE OF CEMENT INGREDIENTS

Ingredient	Per cent	Range
Lime	(CaO)..... 62	62 to 67
Silica	(SiO ₂)..... 22	17 to 25
Alumina	(Al ₂ O ₃)..... 5	3 to 8
Calcium sulphate	(CaSO ₄)..... 4	3 to 4
Iron oxide	(Fe ₂ O ₃)..... 3	3 to 4
Magnesia	(MgO) 2	1 to 3
Sulphur	(S) 1	1 to 3
Alkalies 1	0.2 to 1
Total 100	

Proportion of Cement Ingredients

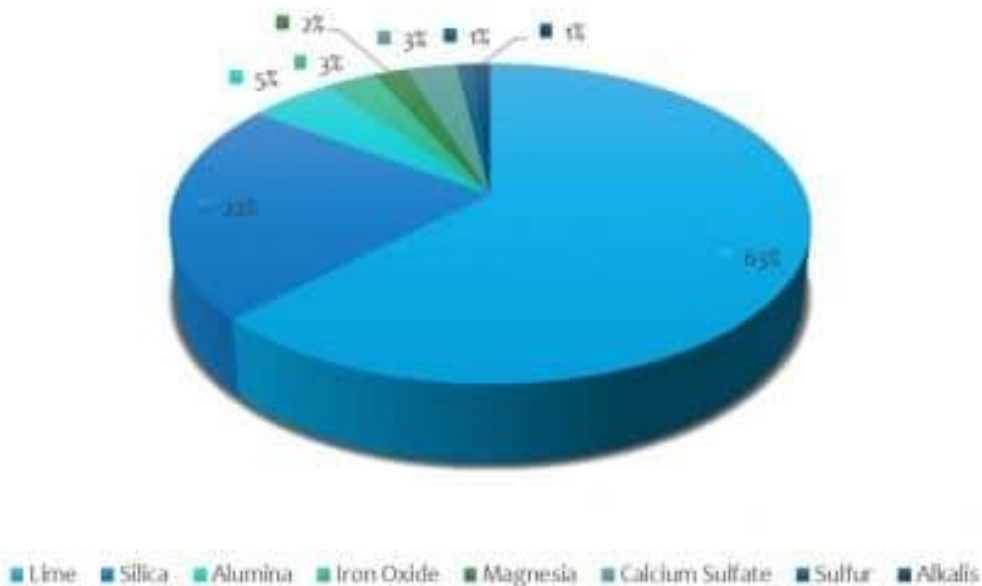


Fig 2: cement ingredients

(2) Silica (SiO₂):

It is also the main ingredient of cement which is about 17 to 25%.

(3) Alumina (Al₂O₃):

This ingredient imparts quick setting property to the cement.

(4) Calcium Sulphate (CaSO₄):

It is present in the form of gypsum in the cement and found composed with limestone.

(5) Iron Oxide (Fe₂O₃):

The property of this ingredient imparts colour, hardness and strength to the cement.

(6) Magnesia (MgO):

Excess quantity makes the cement unsound and also reduces the strength of the cement .

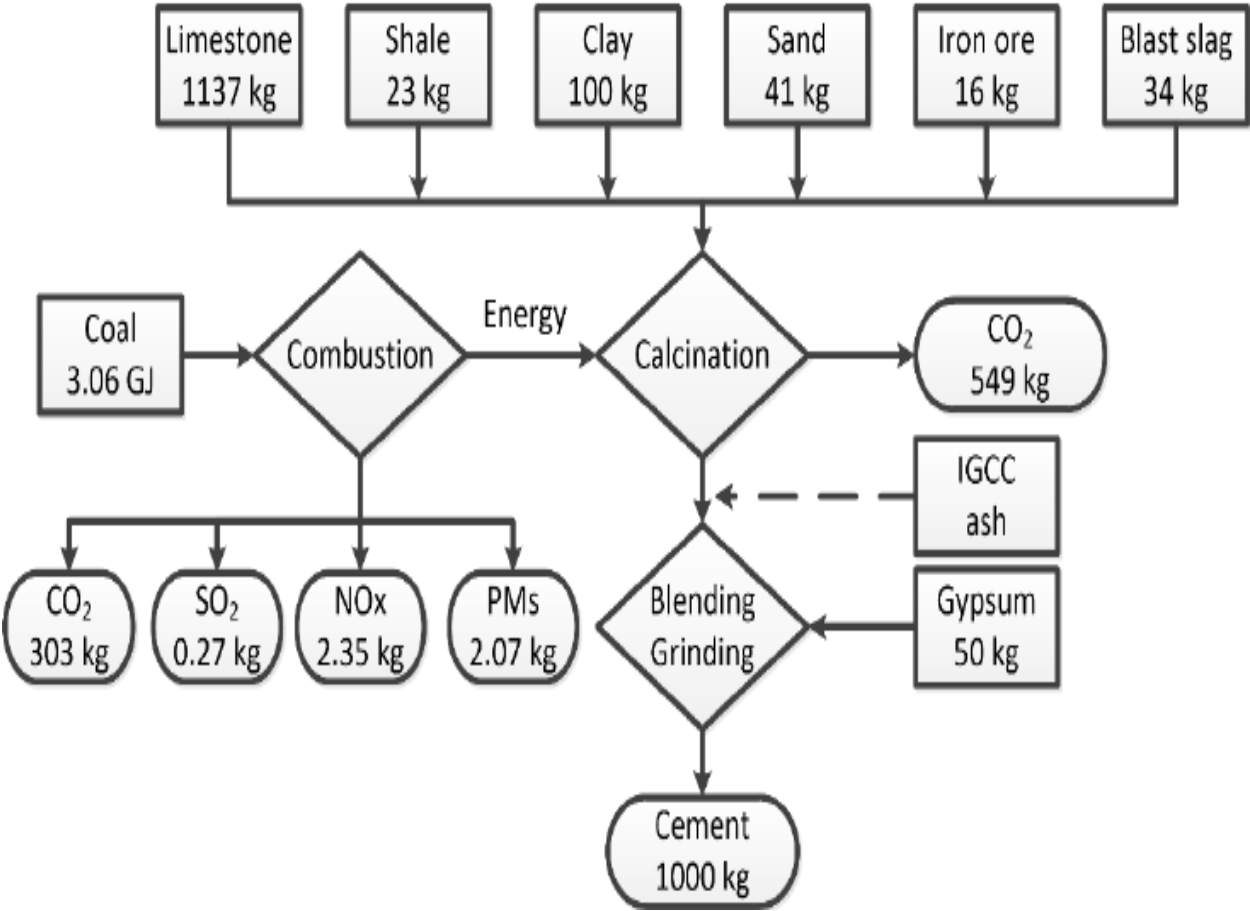


Fig 3: Conventional Portland cement production

III. CONCLUSION

In this paper, we have discussed about the Portland cement and function of ingredients used in manufacturing the Portland cement. In this paper we have also calculated the ratio of various cement ingredients with its properties. The possible reasons for variation in chemical compositions and their consequences have been discussed.

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