Forest Chemicals Review
ISSN: 1520-0191
Issue: May-June 2020 | **Pages:** 07 - 10

Analysis of Global Portland Cement Market Size and Share with Properties

Mohd Armi Abu Samah
Kulliyyah of Science,
IIUM Kuantan, Pahang.
marmi@iium.edu.my

Abstract

Portland cement concrete that is hydraulic cement when combined with water, hardens into a solid mass. Chemical analysis of cement raw materials gave knowledge into the substance properties of cement. In this paper we are discussing about the various chemical composition and properties of Portland cement. In this paper we are also discussing about the market size of Portland cement and application of cement and their ratio.

Keywords*: Lime, Silica, fineness. gypsum etc.*

I. INTRODUCTION

Portland cement is a simple ingredient of concrete. Portland cement makes a paste with water that binds with sand and rock to hardento form a concrete. These cement has a chemical composition of calcium, silicon, aluminum, iron and other ingredients. Non-hydraulic cements **,** and hydraulic cement are 2 important classes of development cement. Non-hydraulic cement does not set in wet conditions or under water. Hydraulic cements set and become adhesive due to a chemical reaction between the dry ingredients and water.

Non-hydraulic cements e.g.
(i) Plaster of Paris ($CaSO_4.{}^1/_2\ H_2O$)
$CaSO_4.{}^1/_2\ H_2O + 1{}^1/_2 H_2O \Rightarrow CaSO_4.2H_2O$ (gypsum)

(ii) lime-based cement (CaO)
$CaO + H_2O \Rightarrow Ca(OH)_2 + CO_2 \rightarrow CaCO_3$ (calcite)

II. PORTLAND CEMENT CHEMICAL COMPOUNDS OF PORTLAND CEMENT

It is create by finely ground limestone and finely divided clay to give a burned product containing 65-70% CaO, 18-24% SiO_2, 3-8% Fe_2O_3, 3-8% Al_2O_3 with some others Na_2O, K_2O,

MgO, etc. Present day plants grant considerably more proficient handling and moreover, proportion raw mix compositions to create a cement from which a range of strength development and robustness properties can be expected. Effective crushing and mixing of raw materials is fundamental.

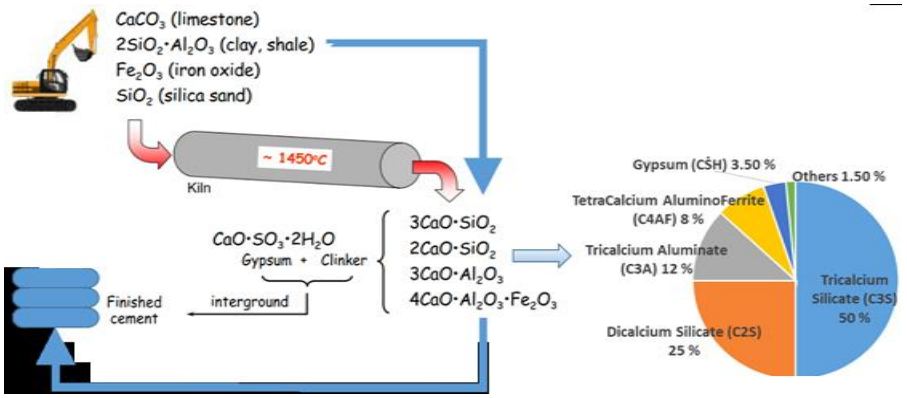

Fig 1 Portland Cement manufacturing

This table shows the chemical compounds of Portland cement, its formula and properties of this compound with weight.

TABLE 1
CHEMICAL COMPOUNDS OF PORTLAND CEMENT

Compound	Formula	Shorthand form	% by weight	Properties of cement compounds
Alite or tricalcium silicate	Ca_3SiO_4	C_3S	50 - 70%	▪ It is responsible for early strength ▪ First 7 days strength is due to C3S ▪ It produces more heat of hydration ▪ Cement with more C3S is better for cold weather concreting.
Belite or dicalcium silicate	Ca_2SiO_5	C_2S	15 - 30%	▪ C2S hydrates after 7 days. Hence, it gives strength after 7 days. ▪ C2S hydrates and harden slowly and provides much of the ultimate strength ▪ It produces less heat of hydration. ▪ Responsible for long term strength
Tricalcium aluminate	$Ca_3Al_2O_6$	C_3A	5 - 10%	▪ The reaction of C3A with water is very fast and may lead to an immediate stiffening of paste, and this process is termed as **flash set.** ▪ To prevent this flash set, 2 to 3% gypsum is added at the time of grinding the cement clinkers. ▪ C3A liberates a lot of heat during the early stages of hydration, but has little (almost none) strength contribution. ▪ Cement low in C3A is sulfate resistant.
Tetracalcium aluminoferrite	$Ca_4Al_2Fe_2O_{10}$	C4AF	5-15%	▪ It hydrates very rapidly. ▪ Contributes very little strength of concrete even though ▪ Also responsible for grey colour of Ordinary Portland Cement ▪ The hydrates of C4AF show a comparatively higher resistance to sulphate attaches than the hydrates of C3A
Sodium oxide	Na_2O	N	0.5 - 1.3%	
Potassium oxide	K_2O	K		
Gypsum	$CaSO_4.2H_2O$	CSH_2		

The graph 2 shows the market size of Portland cement and other from 2014 to expected 2015. Fig 3 shows the application of cement and their ratio.

III. ANALYSIS OF GLOBAL PORTLAND CEMENT MARKET SIZE AND SHARE

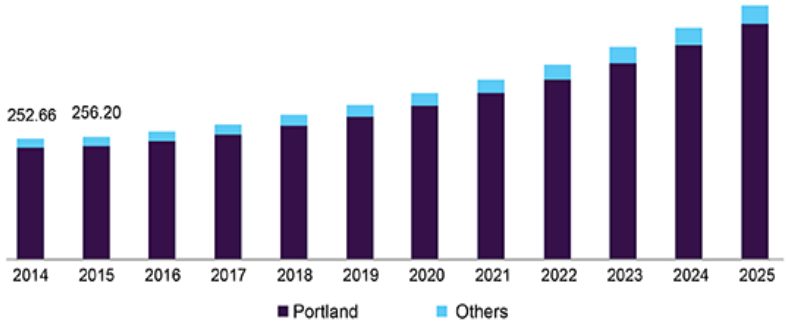

Fig 2 Cement market size

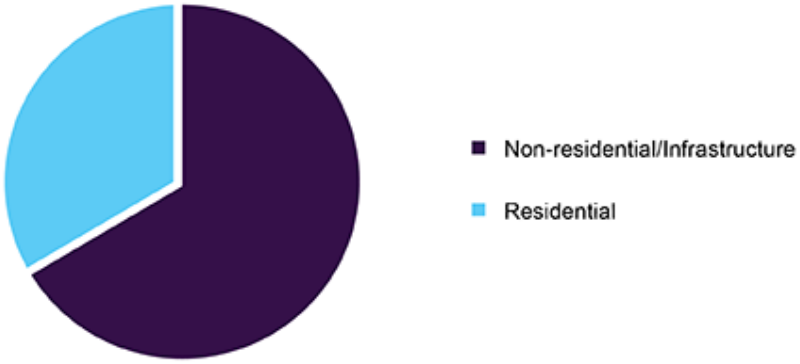

Fig 3 Global cement market share

IV. CONCLUSION

Portland cement is used in worldwide. In this paper we have discussed about the various chemical composition and properties of Portland cement. In this paper we have also discussed about the market size of Portland cement and application of cement and their ratio.

REFERENCES

[1] C. M. Hanson, “Concrete: the advanced industrial material of the 21st century,” Metallurgical & Materials Transactions A, vol. 26, pp. 1321–1341, 1995.

[2] M. Bediako, S. K. Y. Gawu, and A. A. Adjaottor, "Suitability of some Ghanaian mineral admixtures for masonry mortar formulation," Construction and Building Materials, vol. 29, pp. 667–671, 2012.
[3] S. H. Kosmatka, B. Kerkhoff, and W. C. Panarese, Design and Control of Concrete Mixtures, Portland Cement Association,Skokie, Ill, USA, 14th edition, 2002.
[4] M. S. Mamlouk and J. P. Zaniewski, Materials for Civil andConstruction Engineers, Prentice Hall, Upper Saddle River, NJ,USA, 2006.
[5] T. Punmatharith, M. Rachakornkij, A. Imyim, and M.Wecharatana, "Co-processing of grinding sludge as alternative raw material in portland cement clinker production," Journal of Applied Sciences, vol. 10, no. 15, pp. 1525–1535, 2010.
[6] D. N. Huntzinger and T. D. Eatmon, "A life-cycle assessment of Portland cement manufacturing: comparing the traditional process with alternative technologies," Journal of Cleaner Production, vol. 17, no. 7, pp. 668–675, 2009.
[7] F. M. Lea, The Chemistry of Cement and Concrete, Arnold Publishers, London, UK, 3rd edition, 1970.
[8] J. F. Young, S.Mindess, R. J. Gray, andA. Bentur,TheScience andTechnology of Civil Engineering Materials, Prentice-Hall, Upper Saddle River, NJ, USA, 1998.
[9] H. F. W. Taylor, Cement Chemistry, Thomas Telford, London,UK, 2nd edition, 1997.
[10] S. H. Kosmatka and M. L. Wilson, Design and Control of Concrete Mixtures, Portland Cement Association, Stokie, Ill, USA, 2011.
[11] V. Sata, C. Jaturapitakkul, and K. Kiattikomol, "Influence of pozzolan from various by-product materials on mechanical properties of high-strength concrete," Construction and BuildingMaterials, vol. 21, no. 7, pp. 1589–1598, 2007.
[12] A. Neville, Neville on Concrete, ACI, Farmington Hills, Mich, USA, 2003.
[13] R. Fernandez, F. Martirena, and K. L. Scrivener, "The origin of the pozzolanic activity of calcined clay minerals: a comparison between kaolinite, illite and montmorillonite," Cement and Concrete Research, vol. 41, no. 1, pp. 113–122, 2011.
[14] K. Ganesan, K. Rajagopal, and K. Thangavel, "Evaluation of bagasse ash as supplementary cementitious material," Cement and Concrete Composites, vol. 29, no. 6, pp. 515–524, 2007.
[15] S. Sinthaworn and P. Nimityongskul, "Quick monitoring of pozzolanic reactivity of waste ashes," Waste Management, vol.29, no. 5, pp. 1526–1531, 2009.
[16] J. J. Brooks,M. A.M. Johari, andM.Mazloom, "Effect of admixtures on the setting times of high-strength concrete," Cement and Concrete Composites, vol. 22, no. 4, pp. 293–301, 2000.
[17] X. Fu, Z.Wang,W. Tao et al., "Studies on blended cement with a large amount of fly ash," Cement and Concrete Research, vol. 32,no. 7, pp. 1153–1159, 2002.
[18] E.-H. Kadri, S. Kenai, K. Ezziane, R. Siddique, and G. De Schutter, "Influence of metakaolin and silica fume on the heat of hydration and compressive strength development of mortar," Applied Clay Science, vol. 53, no. 4, pp. 704–708, 2011.
[19] V. Indrawati and A. Manaf, "Mechanical strength of trass as supplementary cementing material," Journal of Physical Science, vol. 92, no. 2, pp. 51–59, 2008.