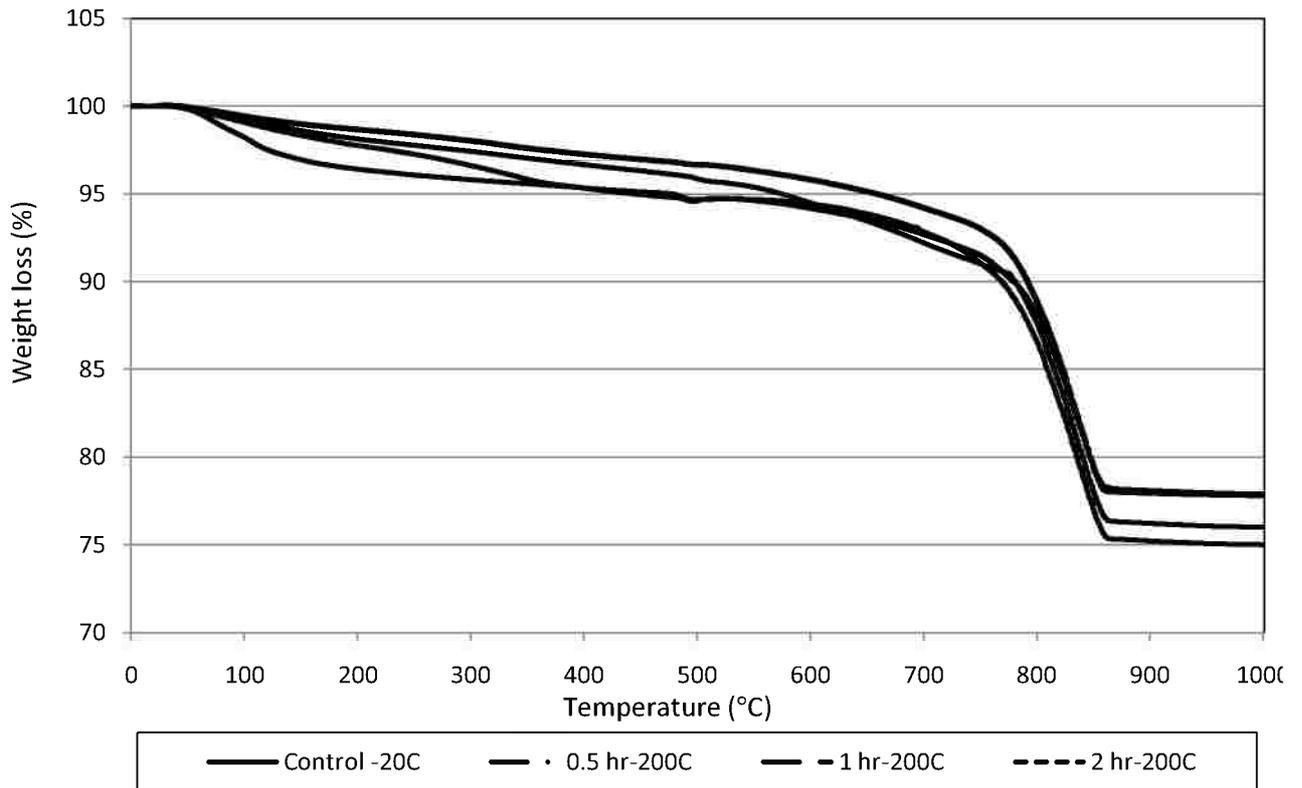


## **CHAPTER 5**

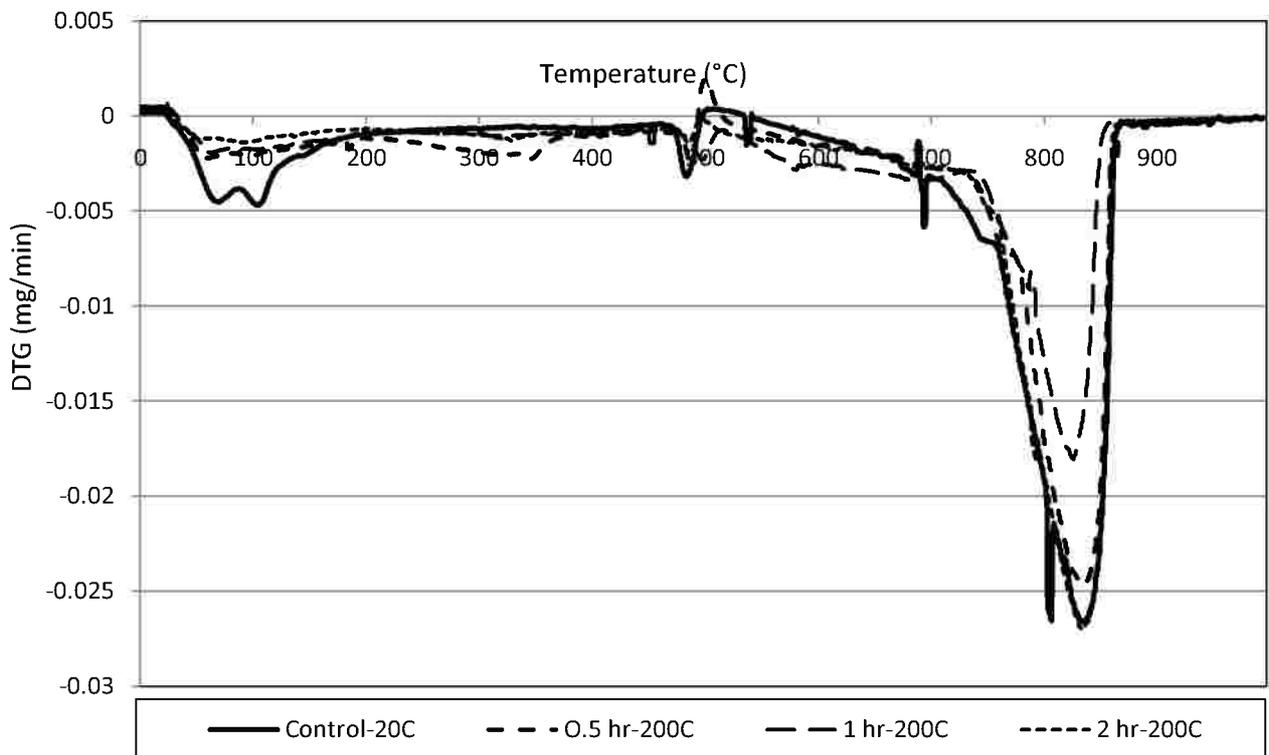
**Performance based approach for estimation  
the elevated temperature degree and the  
exposure duration using TGA**

### **5.1 Methodology of using TGA test to estimate the exposure degree of temperature and the exposure duration of fire.**

The objective of this part is to show how the results of TGA testing can be used to estimate the exposure temperature or the duration of exposure. This principle depends on determining the TGA weight loss percentages of specimens that were exposed to elevated temperature for different periods before the TGA was done. For this aim three groups with 27, 100mm conventional concrete cubes were exposed to 200, 400 and 600°C for three different periods for 0.5, 1 and 2 hrs. After air regime cooling, powder samples with 40 mg weight were taken from inside the cubes just about 1 mm from the surface and were analyzed by thermogravimetric analysis (TGA/DTG). The TGA/DTG curves of the studied samples were plotted from **Fig. 5.1** to **Fig. 5.3** and from them it can be determined the total weight loss of each sample as presented in **Table 5.1** and **Fig. 5.4**. The total weight loss is the average of three specimens for more accurate. From **Fig. 5.4**, the exposure temperature can be determined by knowing the weight loss determined from TGA and exposure duration or on reversing, it can be determine the exposure duration by knowing weight loss from TGA and exposure temperature. The curves of weight loss in **Fig. 5.4** can be done for further exposure temperature at 800, 1000°C....etc and further exposure duration to cover wide range. Also the weight loss determined from TGA should be done for different mixtures with different cement content, w/c and compressive strength ....etc. These curves can be used as a guide in case of fire accident of the building.

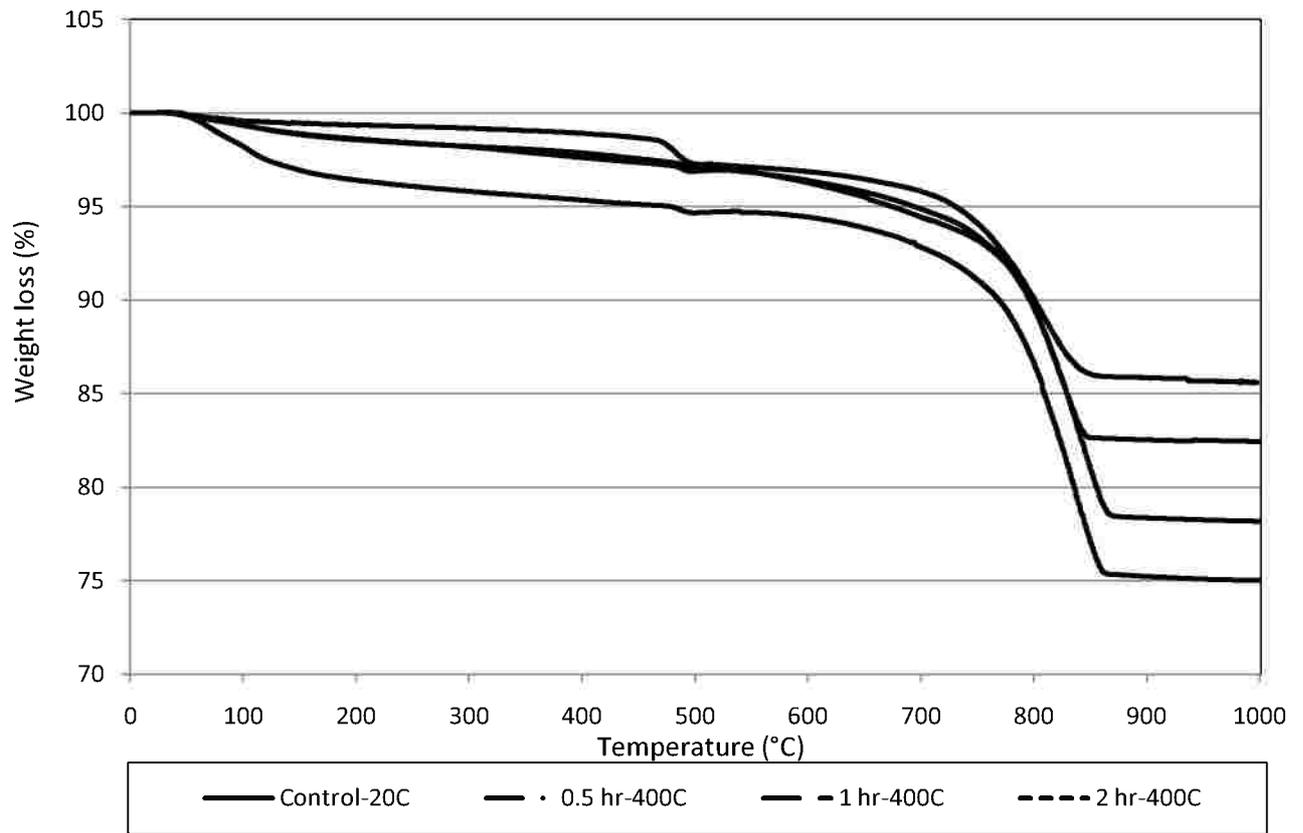


(a)

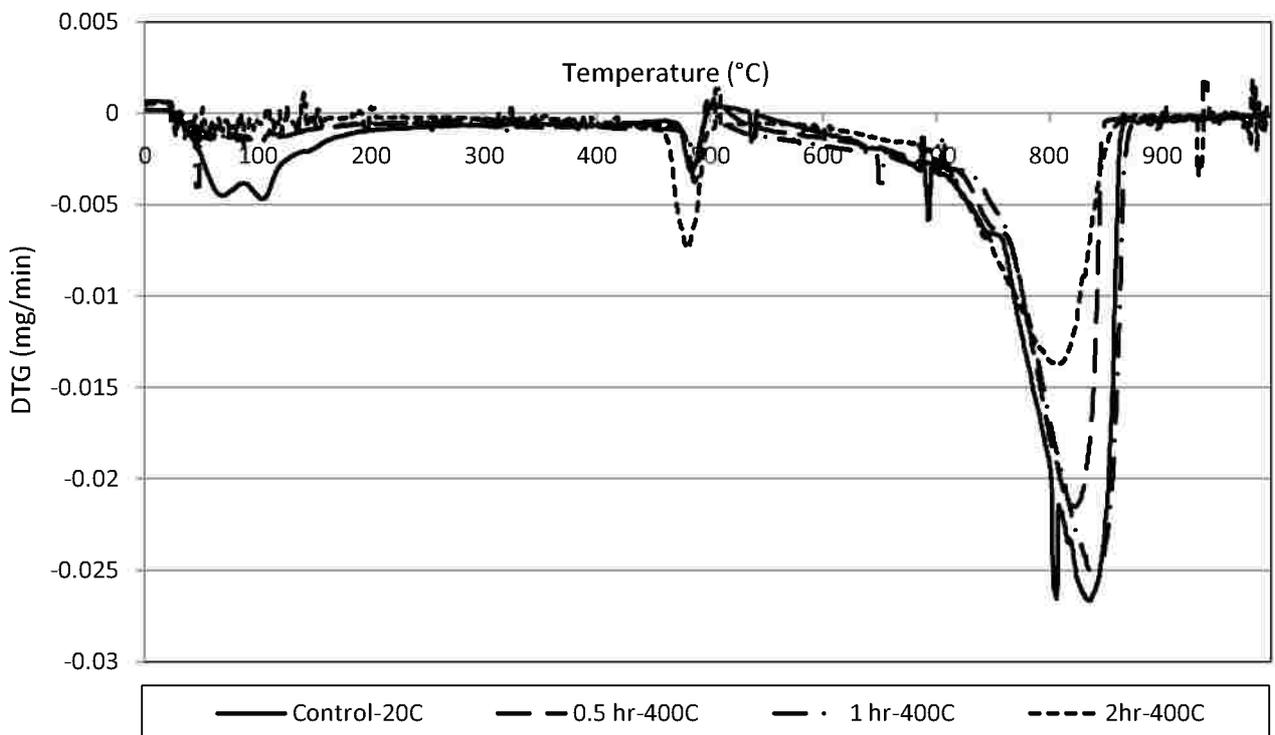


(b)

**Fig.5.1** -(TGA/DTG) curves of unheated and preheated conventional concrete at 200° C for 0.5, 1 and 2 hrs. a) TGA b) DTG.

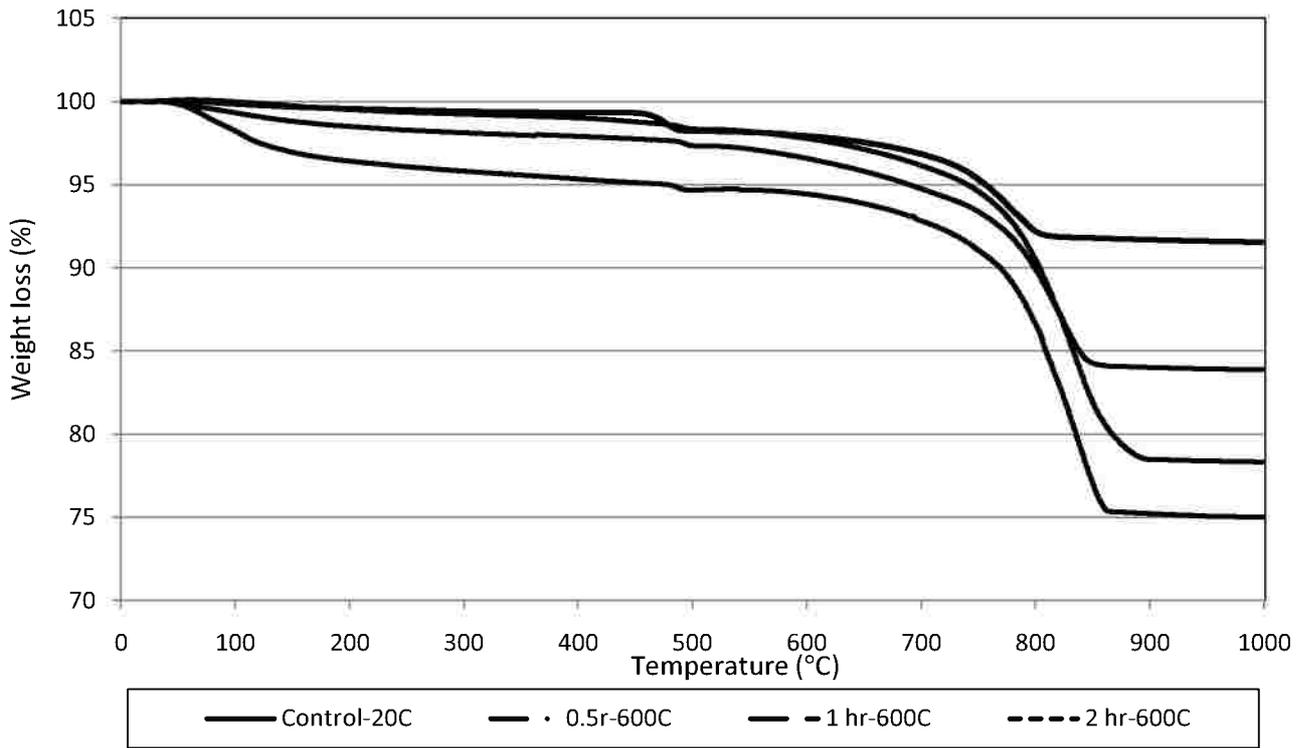


(a)

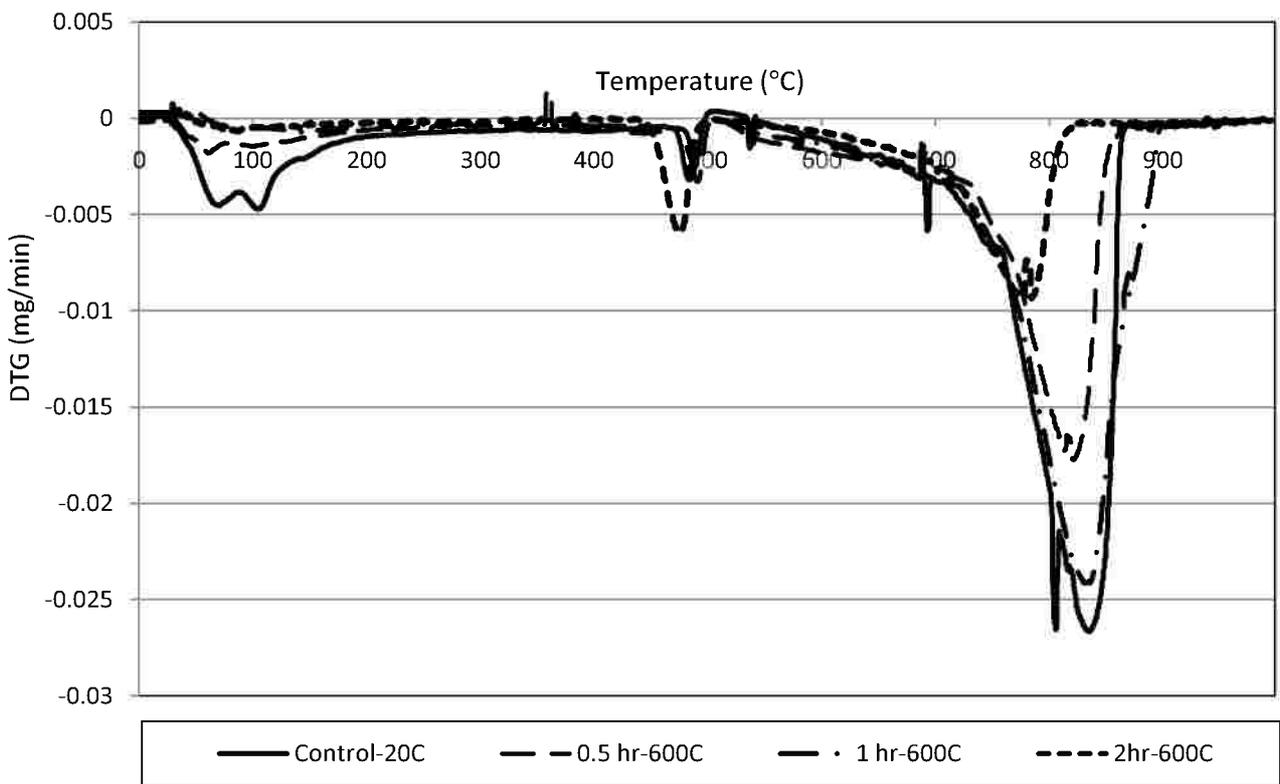


(b)

**Fig.5.2** -(TGA/DTG) curves of unheated and preheated conventional concrete at 400° C for 0.5, 1 and 2 hrs. a) TGA b) DTG.



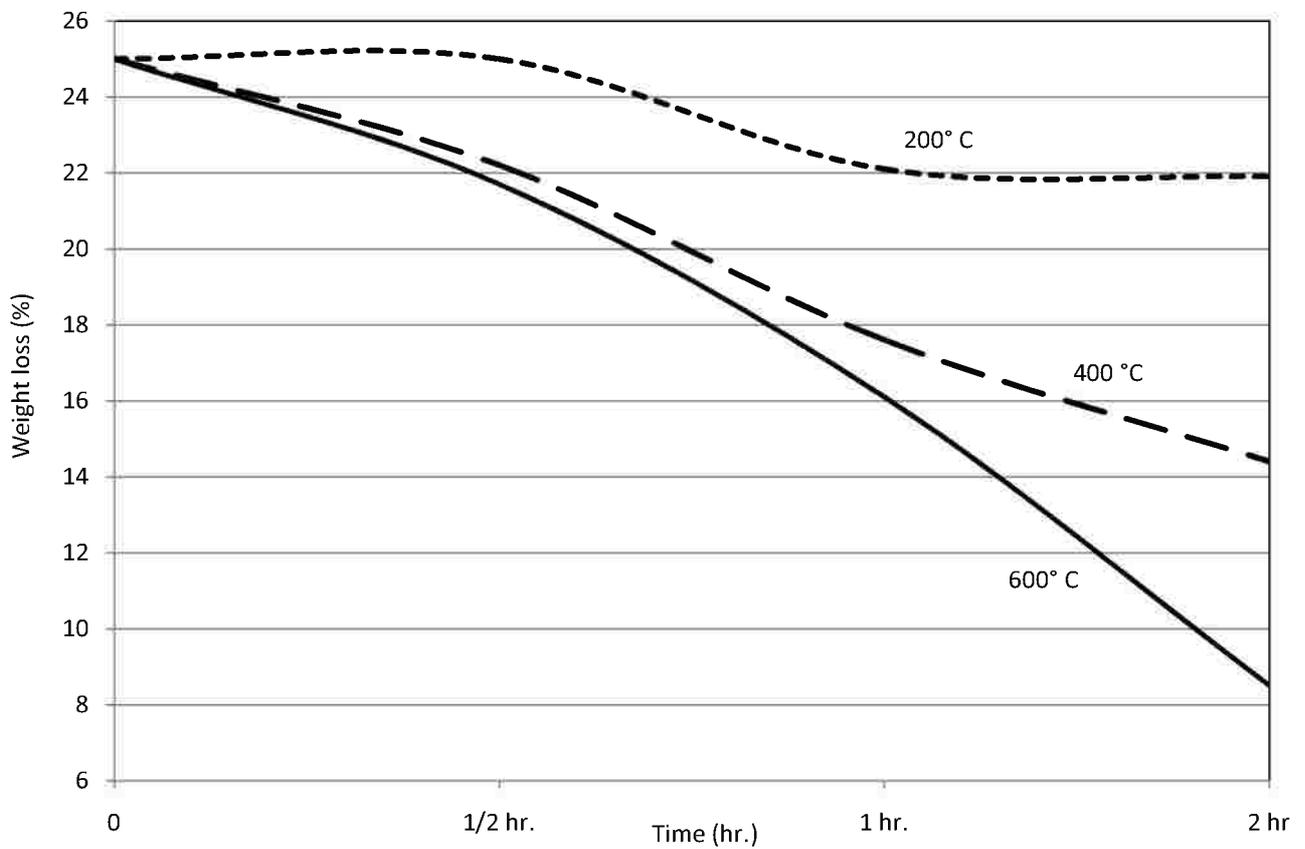
(a)



**Fig.5.3** - (TGA/DTG) curves of unheated and preheated conventional concrete at 600° C for 0.5, 1 and 2 hrs. a) TGA b) DTG.

**Table 5.1:** TGA weight loss (%) of unheated and preheated conventional concrete at 200, 400 and 600°C for 0.5, 1 and 2 hr.

Preheated temperature (°C)	Weight loss (%)			
	Duration (hr)			
	0	0.5	1	2
200	25	25	22.1	21.9
400	25	22.2	17.6	14.4
600	25	21.7	16.1	8.5



**Fig. 5.4-** TGA weight loss (%) of unheated and preheated conventional concrete at 200, 400 and 600°C for different duration of temperature exposure 0.5, 1 and 2 hrs.