

# **CHAPTER - 3**

(Development of Porous  
MgO by Pore forming  
Agent)

This Chapter deals the preparation of porous MgO by Ex potato starch in different temperature and soaking period for desirable property (Mechanical and Physical manner with respect to temperature ).MgO ,Starch and PVA mixing (60:30:10), milled for 3 hour and fired at different temperature and soaking period.

**3.1. Preparation of Porous MgO firing temp 1100°C SP 1h**

<b>MgO</b>	<b>Starch ( Potato)</b>	<b>PVA</b>
<b>Mixing (60:30:10)</b>		
<b>Milled (3h)</b>		
<b>Pressing ( 8 tonn)</b>		
<b>Drying (120°C)</b>		
<b>(M1) Firing at Temperature 1100°C (SP 1h)</b>		

**Block Diagram 3.1 40 % Porous MgO firing temp 1100 °C at Soaking period 1 hour (M1)**

<b>MgO</b>	<b>Starch ( Potato)</b>	<b>PVA</b>
<b>Mixing (70:20:10)</b>		
<b>Milled (3h)</b>		
<b>Pressing ( 8 tonn)</b>		
<b>Drying (120°C)</b>		
<b>(M2) Firing at Temperature 1100°C (SP 1h)</b>		

**Block Diagram 3.2 30% Porous MgO firing temp 1100 °C at Soaking period 1 hour (M2)**

### 3.2 Preparation of Porous MgO firing temp 1200°C SP 1h

<b>MgO</b>	<b>Starch ( Potato)</b>	<b>PVA</b>
<b>Mixing (60:30:10)</b>		
<b>Milled (3h)</b>		
<b>Pressing ( 8 tonn)</b>		
<b>Drying (120°C)</b>		
<b>(M3 ) Firing at Temperature 1200°C (SP 1h)</b>		

**Block Diagram 3.3 40 % Porous MgO firing temp 1200 °C at Soaking period 1 hour (M3)**

<b>MgO</b>	<b>Starch ( Potato)</b>	<b>PVA</b>
<b>Mixing (70:0:10)</b>		
<b>Milled (3h)</b>		
<b>Pressing ( 8 tonn)</b>		
<b>Drying (120°C)</b>		
<b>(M4) Firing at Temperature 1200°C (SP 1h)</b>		

**Block Diagram 3.4 30 % Porous MgO firing temp 1200 °C at Soaking period 1 hour (M4)**

### 3.3 Preparation of Porous MgO firing temp 1300°C SP 1h

<b>MgO</b>	<b>Starch ( Potato)</b>	<b>PVA</b>
<b>Mixing (60:30:10)</b>		
<b>Milled (3h)</b>		
<b>Pressing ( 8 tonn)</b>		
<b>Drying (120°C)</b>		
<b>(M5) Firing at Temperature 1300°C (SP 1h)</b>		

**Block Diagram 3.5 40% Porous MgO firing temp 1300 °C at Soaking period 1 hour (M5)**

<b>MgO</b>	<b>Starch ( Potato)</b>	<b>PVA</b>
<b>Mixing (70:20:10)</b>		
<b>Milled (3h)</b>		
<b>Pressing ( 8 tonn)</b>		
<b>Drying (120°C)</b>		
<b>(M6) Firing at Temperature 1300°C (SP 1h)</b>		

**Block Diagram 3.6 30 % Porous MgO firing temp 1300 °C at Soaking period 1 hour (M6)**

**3.4 Preparation of Porous MgO firing temp 1100°C SP 2h**

<b>MgO</b>	<b>Starch ( Potato)</b>	<b>PVA</b>
<b>Mixing (60:30:10)</b>		
<b>Milled (3h)</b>		
<b>Pressing ( 8 tonn)</b>		
<b>Drying (120°C)</b>		
<b>(M7) Firing at Temperature 1100°C (SP 2h)</b>		

**Block Diagram 3.7 40 % Porous MgO firing temp 1100 °C at Soaking period 2 hour (M7)**

<b>MgO</b>	<b>Starch ( Potato)</b>	<b>PVA</b>
<b>Mixing (70:20:10)</b>		
<b>Milled (3h)</b>		
<b>Pressing ( 8 tonn)</b>		
<b>Drying (120°C)</b>		
<b>(M8) Firing at Temperature 1100°C (SP 2h)</b>		

**Block Diagram 3.8 30% Porous MgO firing temp 1100 °C at Soaking period 2 hour (M8)**

### 3.5 Preparation of Porous MgO firing temp 1200°C SP 2h

<b>MgO</b>	<b>Starch ( Potato)</b>	<b>PVA</b>
<b>Mixing (60:30:10)</b>		
<b>Milled (3h)</b>		
<b>Pressing ( 8 tonn)</b>		
<b>Drying (120°C)</b>		
<b>Firing at Temperature 1200°C (SP 2h)</b>		

**Block Diagram 3.9 . 40 % Porous MgO firing temp 1200 °C at Soaking period 2 hour (M9)**

<b>MgO</b>	<b>Starch ( Potato)</b>	<b>PVA</b>
<b>Mixing (70:20:10)</b>		
<b>Milled (3h)</b>		
<b>Pressing ( 8 tonn)</b>		
<b>Drying (120°C)</b>		
<b>Firing at Temperature 1200°C (SP 2h)</b>		

**Block Diagram 3.10 30 % Porous MgO firing temp 1200 °C at Soaking period 2 hour (M10)**

### 3.6 Preparation of Porous MgO firing temp 1300°C SP 2h

<b>MgO</b>	<b>Starch ( Potato)</b>	<b>PVA</b>
<b>Mixing (60:30:10)</b>		
<b>Milled (3h)</b>		
<b>Pressing ( 8 tonn)</b>		
<b>Drying (120°C)</b>		
<b>Firing at Temperature 1300°C (SP 2h)</b>		

**Block Diagram 3.11 40 % Porous MgO firing temp 1300 °C at Soaking period 2 hour (M11)**

<b>MgO</b>	<b>Starch ( Potato)</b>	<b>PVA</b>
<b>Mixing (70:20:10)</b>		
<b>Milled (3h)</b>		
<b>Pressing ( 8 tonn)</b>		
<b>Drying (120°C)</b>		
<b>Firing at Temperature 1300°C (SP 2h)</b>		

**Block Diagram 3.12 30 % Porous MgO firing temp 1300 °C at Soaking period 2 hour (M12)**

### 3.7. Measurement of Porous MgO firing temp 1100°C SP 1h

The Measurement of physical and Mechanical Characteristics of porous MgO by physical and Mechanical Apparatus (Archimedes Bulk density and porosity, 3- Point Bending Machine , Water permeability , Corrosion bath , Interlayer Water Measurement Apparatus) are given below.

**Table 3.1 Measurement and Result of 40 % Porous MgO firing temp 1100 °C**

Measurement	Results (SP 1h)
Bulk Density(gm/cc)	1.9
Apparent Porosity (%)	68
Compressive Strength (MPa)	4
Thermal Conductivity (w/mk)	2.32
Corrosion Resistance (%)	3.09
Permeability (cm/sec)	.04
IL water (%)	39

**Table 3.2 Measurement and Result of 30% Porous MgO firing temp 1100 °C**

Measurement	Results (SP 1h)
Bulk Density(gm/cc)	1.89
Apparent Porosity (%)	68.3
Compressive Strength (MPa)	4 .1
Thermal Conductivity (w/mk)	2.32
Corrosion Resistance (%)	3.08
Permeability (cm/sec)	.04
IL water (%)	39



### 3.8 Measurement of Porous MgO firing temp 1200°C SP 1h

**Table 3.3 Measurement and Result of 40 % Porous MgO firing temp 1200 °C**

Measurement	Results (SP 1h)
Bulk Density(gm/cc)	1.9
Apparent Porosity (%)	68
Compressive Strength (MPa)	4
Thermal Conductivity (w/mk)	2.32
Corrosion Resistance (%)	3.09
Pearmeability (cm/sec)	.04
IL water (%)	39
NIL (%)	-----

**Table 3.4 Measurement and Result of 30% Porous MgO firing temp 1200 °C**

Measurement	Results (SP 1h)
Bulk Density(gm/cc)	1.89
Apparent Porosity (%)	68.98
Compressive Strength (MPa)	4.1
Thermal Conductivity (w/mk)	2.32
Corrosion Resistance (%)	3.09
Pearmeability (cm/sec)	.04
IL water (%)	39
NIL (%)	-----

### 3.9 Measurement of Porous MgO firing temp 1300°C SP 1h

**Table 3.5 Measurement and Result of 40 % Porous MgO firing temp 1300 °C**

Measurement	Results (SP 1h)
Bulk Density(gm/cc)	1.93
Apparent Porosity (%)	67.7
Compressive Strength (MPa)	4
Thermal Conductivity (w/mk)	2.31
Corrosion Resistance (%)	3.09
Pearmeability (cm/sec)	.04
IL water (%)	39
NIL (%)	-----

**Table 3.6 Measurement and Result of 30 % Porous MgO firing temp 1300 °C**

Measurement	Results (SP 1h)
Bulk Density(gm/cc)	1.92
Apparent Porosity (%)	67.9
Compressive Strength (MPa)	4.1
Thermal Conductivity (w/mk)	2.31
Corrosion Resistance (%)	3.09
Pearmeability (cm/sec)	.04
IL water (%)	39
NIL (%)	-----

### 3.10 Measurement of Porous MgO firing temp 1100°C SP 2h

**Table 3.7 Measurement and Result of 40 % Porous MgO firing temp 1100 °C at SP 2 h**

Measurement	Results (SP 2h)
Bulk Density(gm/cc)	1.9
Apparent Porosity (%)	68
Compressive Strength (MPa)	4
Thermal Conductivity (w/mk)	2.32
Corrosion Resistance (%)	3.09
Pearmeability (cm/sec)	.04
IL water (%)	39
NIL (%)	-----

**Table 3.8 Measurement and Result of 30 % Porous MgO firing temp 1100 °C at SP 2 h**

Measurement	Results (SP 1h)
Bulk Density(gm/cc)	1.92
Apparent Porosity (%)	68.3
Compressive Strength (MPa)	4.1
Thermal Conductivity (w/mk)	2.31
Corrosion Resistance (%)	3.08
Pearmeability (cm/sec)	.04
IL water (%)	39
NIL (%)	-----

### 3.11 Measurement of Porous MgO firing temp 1200°C SP 2h

**Table 3.9 Measurement and Result of 40 % Porous MgO firing temp 1200 °C at soaking period 2 hour**

Measurement	Results (SP 2h)
Bulk Density(gm/cc)	1.9
Apparent Porosity (%)	68
Compressive Strength (MPa)	4
Thermal Conductivity (w/mk)	2.32
Corrosion Resistance (%)	3.09
Pearmeability (cm/sec)	.04
IL water (%)	39
NIL (%)	-----

**Table 3.10 Measurement and Result of 30% Porous MgO firing temp 1200 °C at soaking period 2 hour**

Measurement	Results (SP 2h)
Bulk Density(gm/cc)	1.92
Apparent Porosity (%)	67.98
Compressive Strength (MPa)	4.1
Thermal Conductivity (w/mk)	2.31
Corrosion Resistance (%)	3.08
Pearmeability (cm/sec)	.04
IL water (%)	39
NIL (%)	-----

### 3.12 Measurement of Porous MgO firing temp 1300°C SP 2h

**Table 3.11 Measurement and Result of 40 % Porous MgO firing temp 1300 °C soaking period 2 hour**

Measurement	Results (SP 2h)
Bulk Density(gm/cc)	1.93
Apparent Porosity (%)	67.7
Compressive Strength (MPa)	4
Thermal Conductivity (w/mk)	2.31
Corrosion Resistance (%)	3.09
Pearmeability (cm/sec)	.04
IL water (%)	39
NIL (%)	-----

**Table 3.12 Measurement and Result of 30 % Porous MgO firing temp 1300 °C soaking period 2 hour**

Measurement	Results (SP 2h)
Bulk Density(gm/cc)	1.9
Apparent Porosity (%)	68
Compressive Strength (MPa)	4
Thermal Conductivity (w/mk)	2.32
Corrosion Resistance (%)	3.09
Pearmeability (cm/sec)	.04
IL water (%)	39
NIL (%)	-----

### 3.13 Characterisation and Pore Size Distribution of Porous MgO

From the Figure 3.1 XRD [Cullity, (2001)] shows no impurity present in crystal of porous MgO as views from JCPDS file for diffraction. From the Figure 3.2 It is lucid that diverse silhouette and size of pores are transpire in porous MgO (68%) firing at 1100 °C , SP 1h, assortment from macron size to nano size. The nano magnitude of pore are not as much of as comparison to microsized pores. From the pore size distribution as shown in Figure 3.3 it is predicted that a quantity of pores are superior than 1 micron where as a little pores are less than 1 micron [Salvini, (2003)]. From the TGA analysis as shown in Figure 3.4 ,no credence loss are observed subsequent to temperature 400 °C [Zawadzki *et al* (2011)].

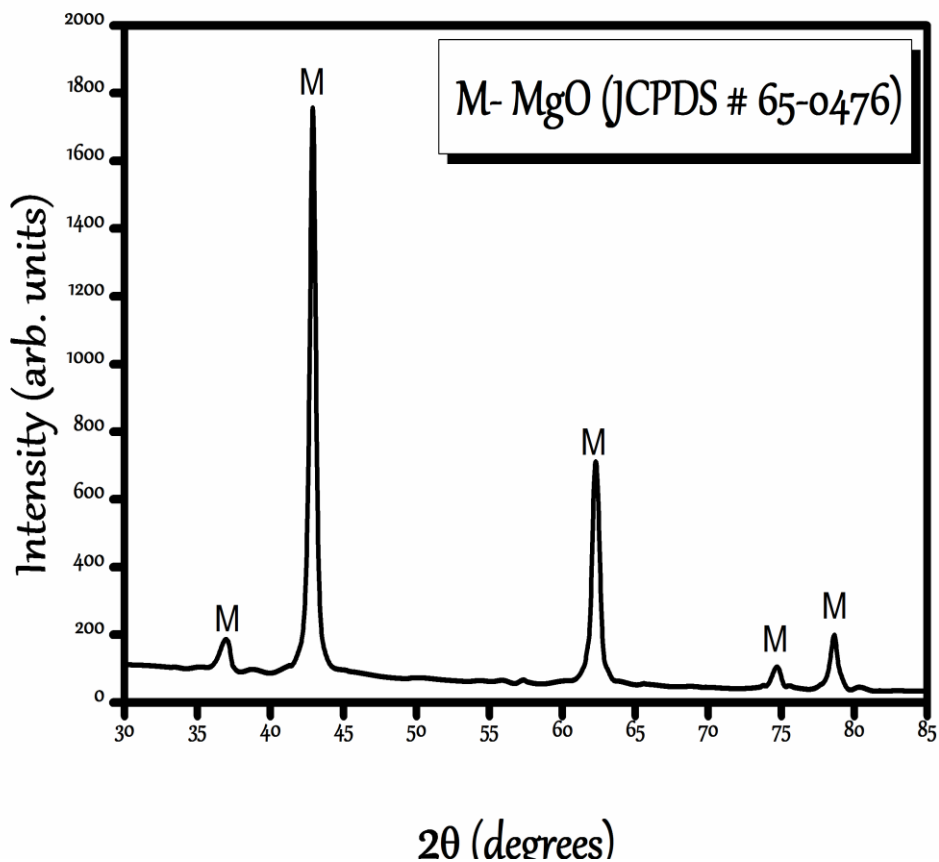
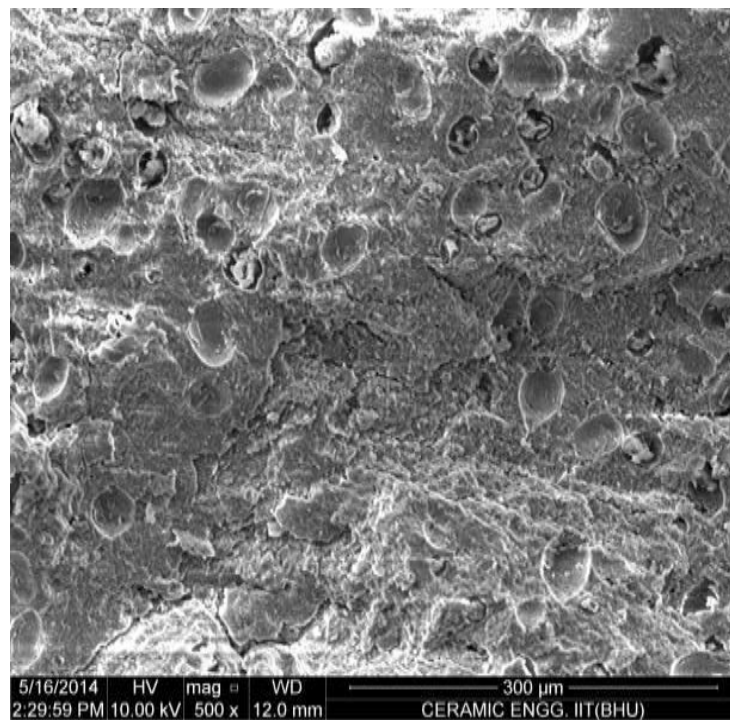
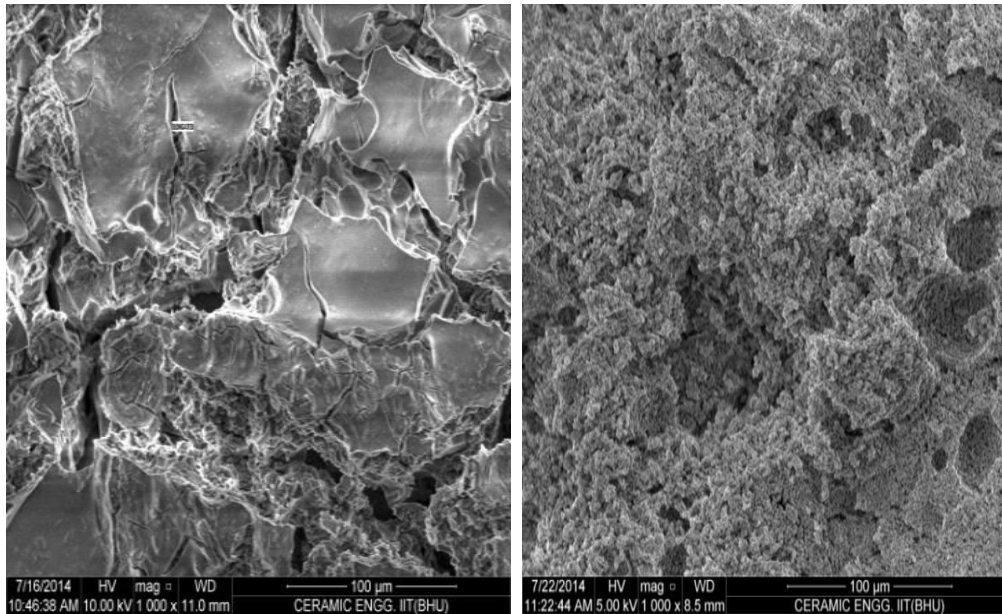
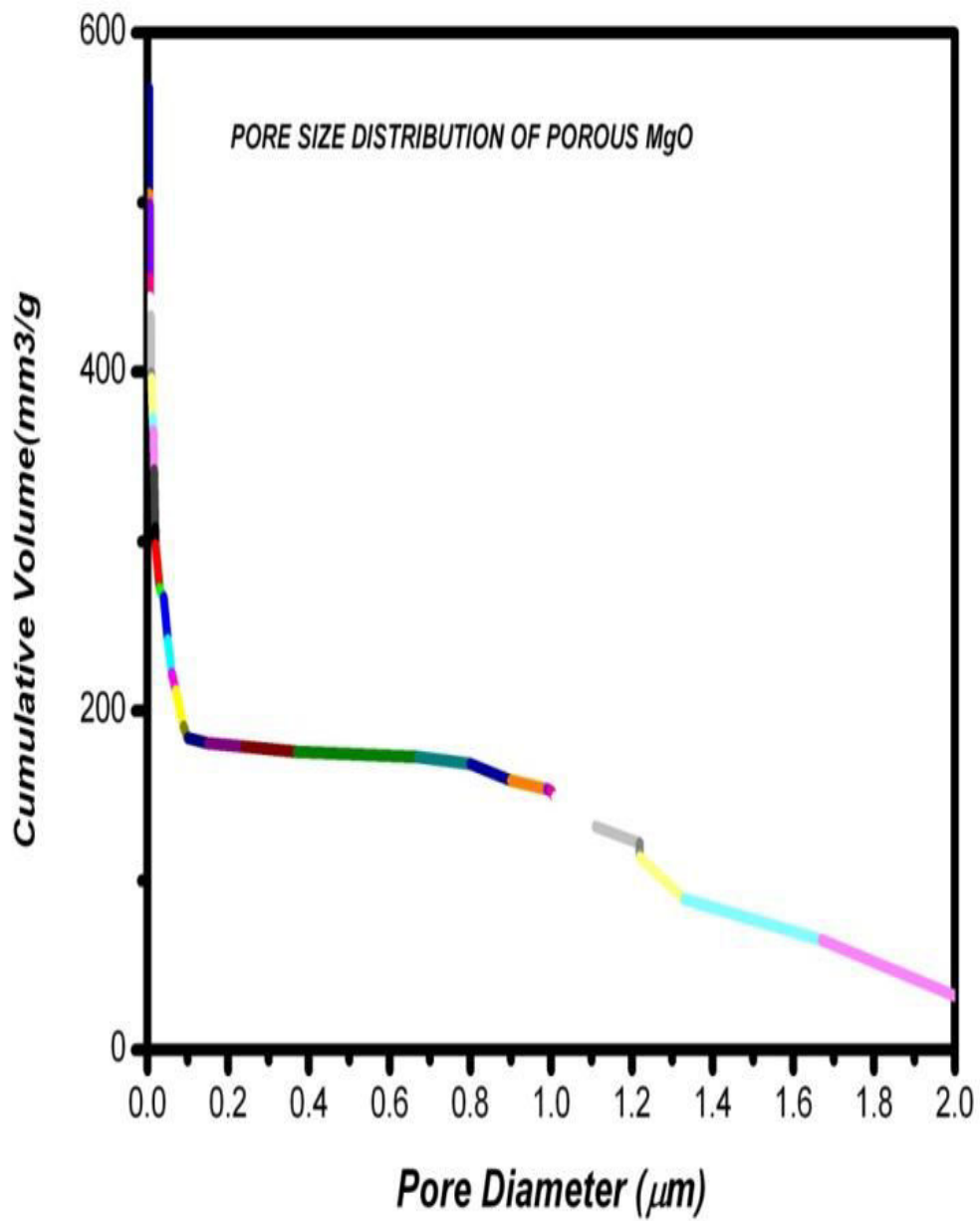


Figure 3.1 XRD of Porous MgO firing temp 1100 °C



**Figure 3.2 SEM of Porous MgO firing temp 1100 °C**



**Figure 3.3** pore size distribution of Porous MgO firing temp 1100 °C (SP 1h)



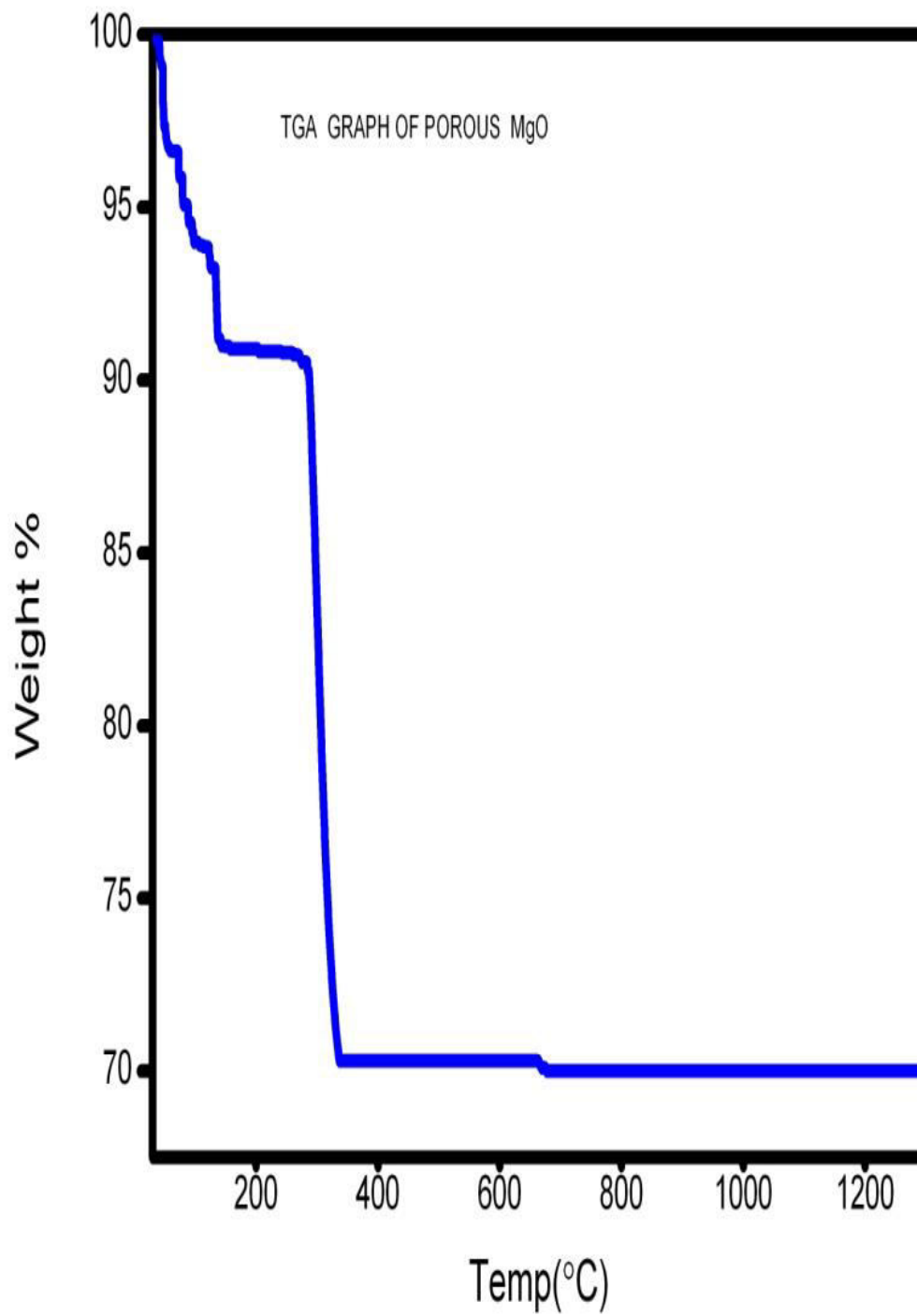


Figure 3.4 TGA of Porous MgO firing temp 1100 °C

### 3.14 Study the Property Ex-POTATO STARCH

1. Low cost
2. easy available
3. Manufactured in lab easy
4. No toxic compound

#### Specification

Facade	calcined powder (superior)
Filtrate on detonation	Max 1.4%
pH (35 °C, 5% in solution)	6.0 - 7.0
Water solubility	outdo test (min)
Appropriateness	outdo test for warmth as indicator