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:

(1)

Gravimetric )

(method

(2)

(Quasi linear heating) (Isothermal heating)

0.4533 gm./min

.(A/F)

.(500- 800 C°)

) (600 C°, 700 C°, 800 C°)

.25 mg/min (

## TREATMENT OF SOOT MASS EMITTED FROM DIESEL ENGINE

### Abstract:

Soot particles emitted from diesel engines to atmosphere pollute the environment air because many hydrocarbons known for their cancerous properties adsorb on its surfaces during the combustion processes of diesel fuel.

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These soot particles have very small diameters (less than 2.5  $\mu\text{m}$ ) and easy enter with air to the human respiratory system during the inhalation process. In order to control of soot emitted from four stroke, direct injection, air cooled and single cylinder diesel engine we executed two important parts; (1) Rate of soot mass emitted from this engine was measured inside the passageway of exhaust gases. One of the gravimetric methods for soot mass measurement in combustion systems was developed to measure the rate of soot emitted from diesel engine. (2) The rate of soot emitted from the engine was treated in a laboratory scale. Different diesel soot mass patterns were prepared according soot mass measured in limited time interval at different engine loads, and then the soot oxidation rates were studied using linear heating and isothermal heating inside the electrical furnace. The results of soot emitted measurements show that the rate of soot emitted significantly increases and reaches, at high engine loads, to 0.4533 mg/min because of highly reduced in A/F ratio. Then large amounts of diesel fuel inside the cylinder suffer from pyrolysis heating. The results of soot mass treatment with linear heating show that the rate of soot mass oxidation is significant at mid and high loads between the temperatures (500- 800 C<sup>o</sup>). It can be concluded, from the results of soot mass oxidation at isothermal heating with different temperatures (600 C<sup>o</sup>, 700 C<sup>o</sup>, 800 C<sup>o</sup>), that the rates of soot mass oxidation at different soot masses (i.e. different engine loads) is approximately equal 25 mg/min.

**Key words:** Diesel engine, Soot emitted, Gravimetric method, Soot oxidation, Isothermal heating.

**:(INTRODUCTIION) -**

(Polycyclic aromatic hydrocarbons, PAHs)

3,1, (Benzene)

,[1] (Carcinogenic)

,(ethylbenzene)

,(o-xylene)

,(1,3-butadiene)

[2]

.(formaldehyde)

,(toluene)

3 1

(leukemia)

,[2,3]

(2.5 μm)

(2.5 μm)

( )

.(Optical methods)

•

.(Direct gravimetric methods)

•

[4, 5]

(Van- Brand method)

-

(Bosch method)

Hartridge )

[7] .[6]

(method

(Rakopoulos, et.al)

(HSDI)

[8,9]

[8,10]

- 
- 

(Fuel- rich region)

Soot particulate treatment in )

[11] (exhaust

(Electrical heater)

[12,13] (Burner)

[14]

[15]

**(EXPERIMENTAL PART)**

**-2**

(Full open rack and variable speed)

(Rack)

(Rack)

" "

**(RIG TEST)**

**(2-1)**

TQ Education )

(1)

(Model TD115)

(and Training Ltd.

**(DIESEL ENGINE)**

**(2-1-1)**

(Model TD111)

(1)

(1)

Specifications of the test engine		
No.	Parameters	Specifications
1	General details	Single cylinder, four stroke, Compression ignition, Variable speed, vertical, Air cooled, direct injection
2	Bore	70 mm
3	Stroke	65 mm
4	Swept volume	250 cm <sup>3</sup>
5	Charging	Natural aspiration
6	Maximum power	4.2 kW at 3750 rpm
7	Manufacturer	TQ Education and Training Ltd.

**(HYDRAULIC DYNAMOMETERIC)**

**(2-1-2)**

(2)

( stator B)

( rotor D)

(needle valve A)

(coupling)

(crank shaft)

(Cable E)

(stator B)

(H)

(stator B)

(F)

(C)

(stator B)

**(INSTRUMENTATION UNIT)****(2-1-3)**

( Model TD114)

(3)

,(C°)

,(rpm)

,(N m)

.(mm H<sub>2</sub>O)

(ml/sec)

**(COLLECTING SOOT PARTICLES SYS****(2-2)**

(Post exhaust)

(Glass wool filter)

(Pyrex

(Soot collecting piece)

(d=7mm)

glass)

(4)

**(SOOT MASS MEASUREMENT )****1-2-2**

(Pyrex glass)

(6)

.1

(200 C°)

(Glass wool filter)

(Desiccator)

(WIGGEN HAUSER, Ltd.)

.2

.3

(1)

(2)

.(4)

10

.4

.(Desiccator)

(4)

(2)

.5

.6

(Downward load)

(Upward load)

**(SOOT PARTICULATE TREATMENT)**

**(3-2)**

( )

(Box- Type Furnace, TIANJIN TAISITE INSTRUMENT Co., Ltd.)

(Quasi- linear heating)

N<sub>2</sub> /O<sub>2</sub>

(Isothermal heating)

(800 C°, 700 C°, 600 C°)

(Crucible)

( )

( WIGGEN HAUSER, Ltd. )

(5b)

(5a)

**(RESULTS and DISCUSSION)**

**-3**

(gm./min)

(6)

,%20

.%100

%70

(22.66 mg/min)



(368.33 mg/min)

(103.26 mg/min)

(A/F)

(7)

( )

(8)

(400C°)

500- 800 )

(C°)

(9)

(600, 700, 800 C°)

(Isothermal heating)

(226.2 mg)

(8-10)

(23-25 mg/min)

(11)

(10)

600, 700, )

1032.6 )

(10)

(800 C°)

23.53 800 C° 700 C° 600 C°

(mg)

26 mg/min 25 mg/min mg/min

(44-36)

(11)

800 C°

3683.3 mg

25 mg/min

150

(800 C°)

**(CONCLUSION)** -4

) .1

(

.2

(500- 800 °C)

( , , ) .3

(600, 700, 800 °C)

(23.53-26 mg/min)

(800 °C) .4

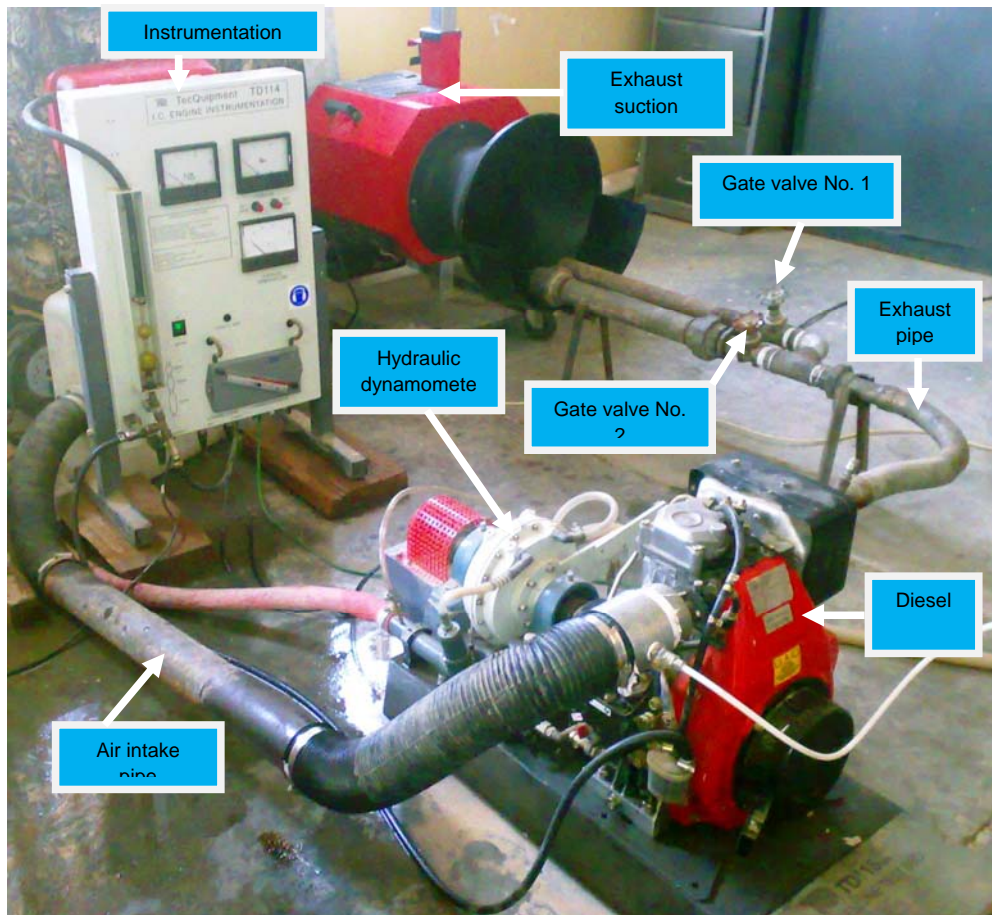
(700 °C) (600 °C)

**(REFERNCES) المصادر -5**

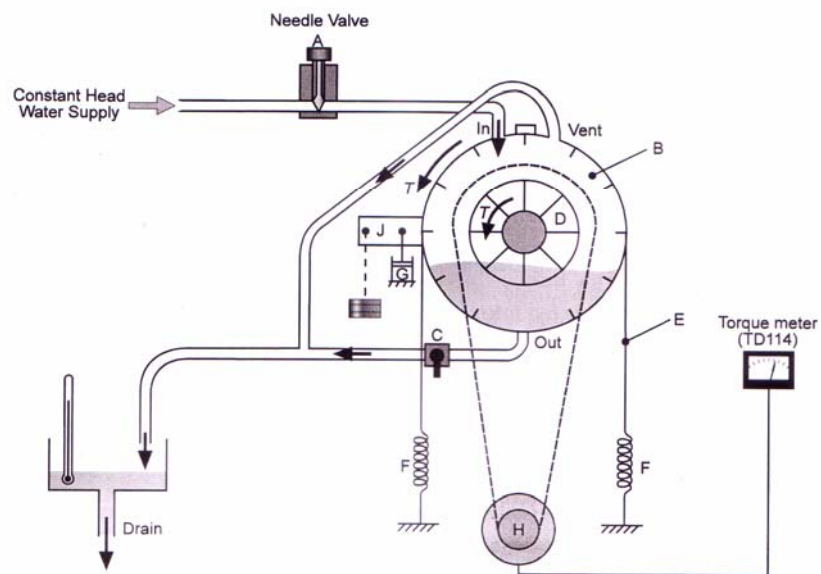
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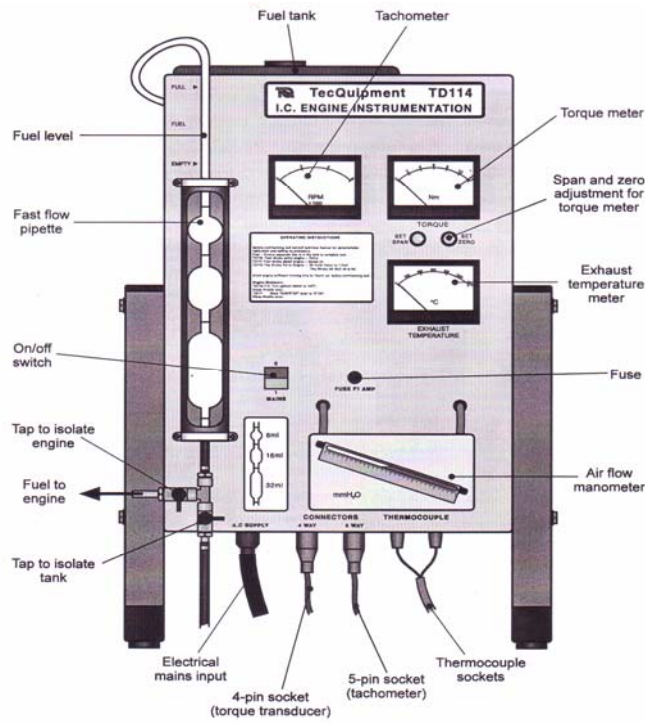
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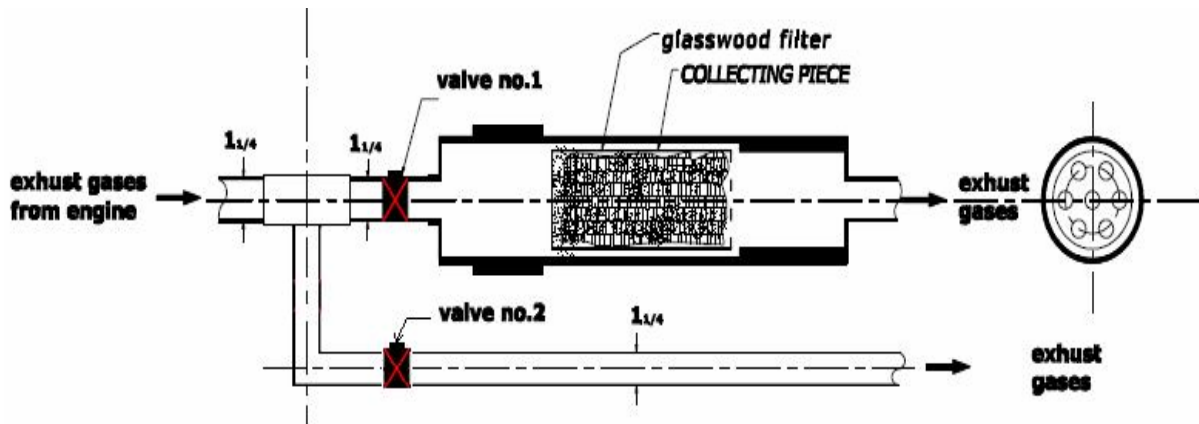
الشكل (1) صورة جهاز الاختبار ومنظومة تجميع السناج



الشكل (2) مخطط وحدة الداينوميتر الهيدروليكي.



الشكل (3) وحدة القياس موديل ( Model- TD114 )



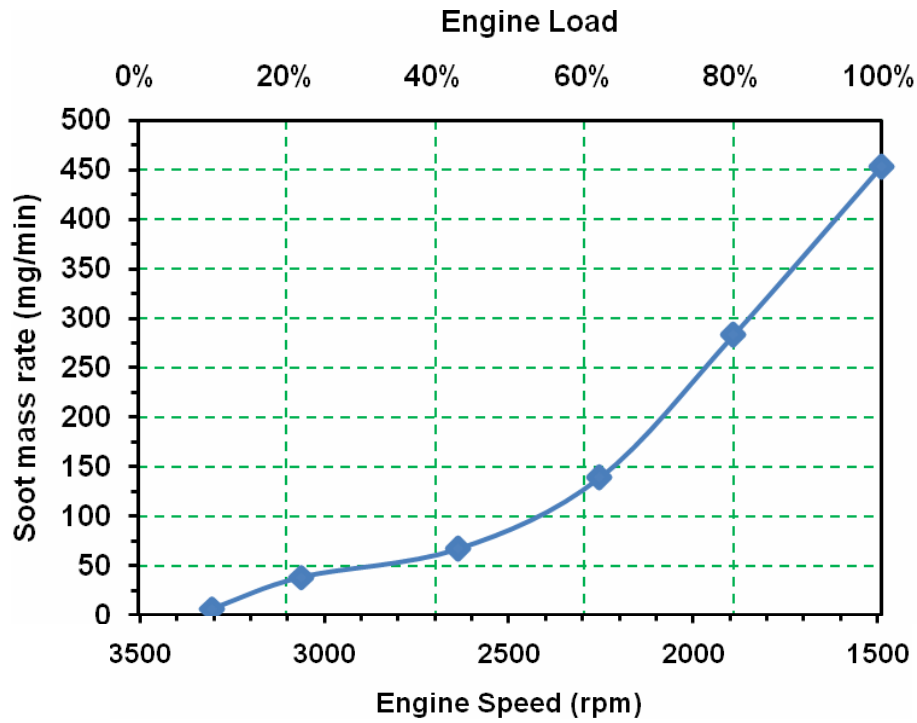
الشكل (4) منظومة تجميع السناج



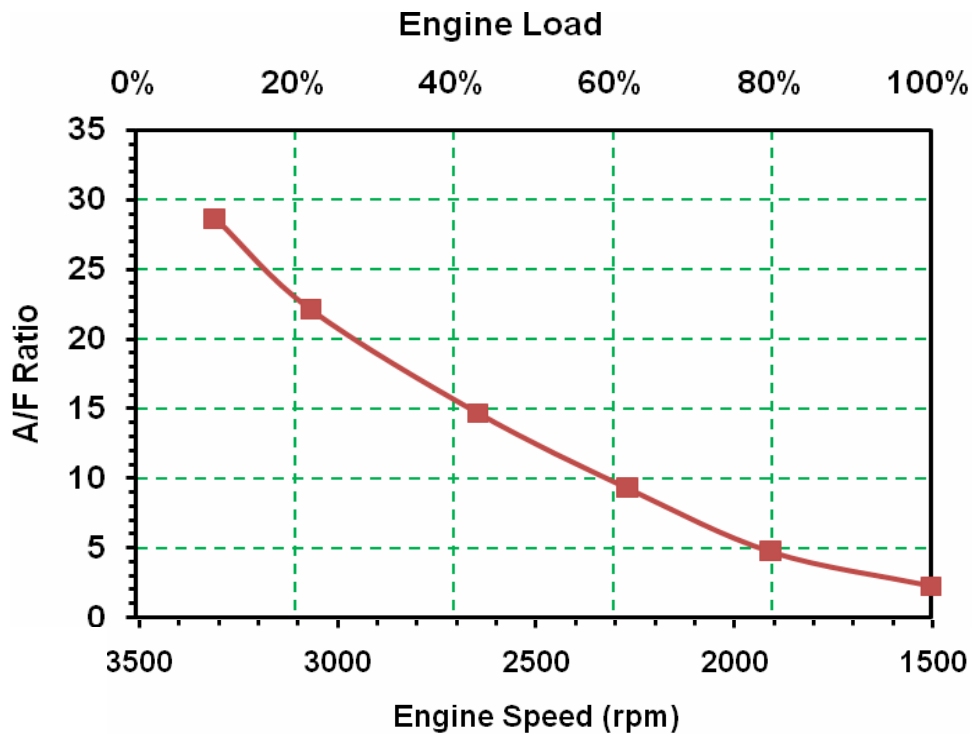
الشكل (5a) عملية وضع بودقات السناج داخل الفرن الكهربائي



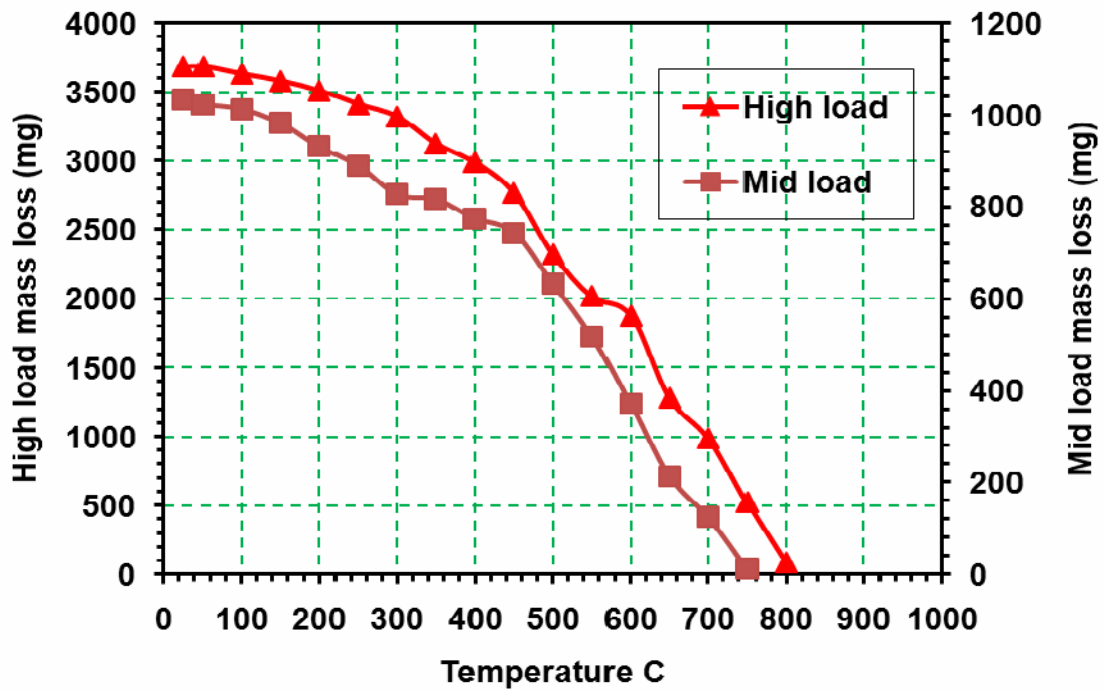
الشكل (5b) قياس وزن السناج قبل وبعد عملية الأكسدة



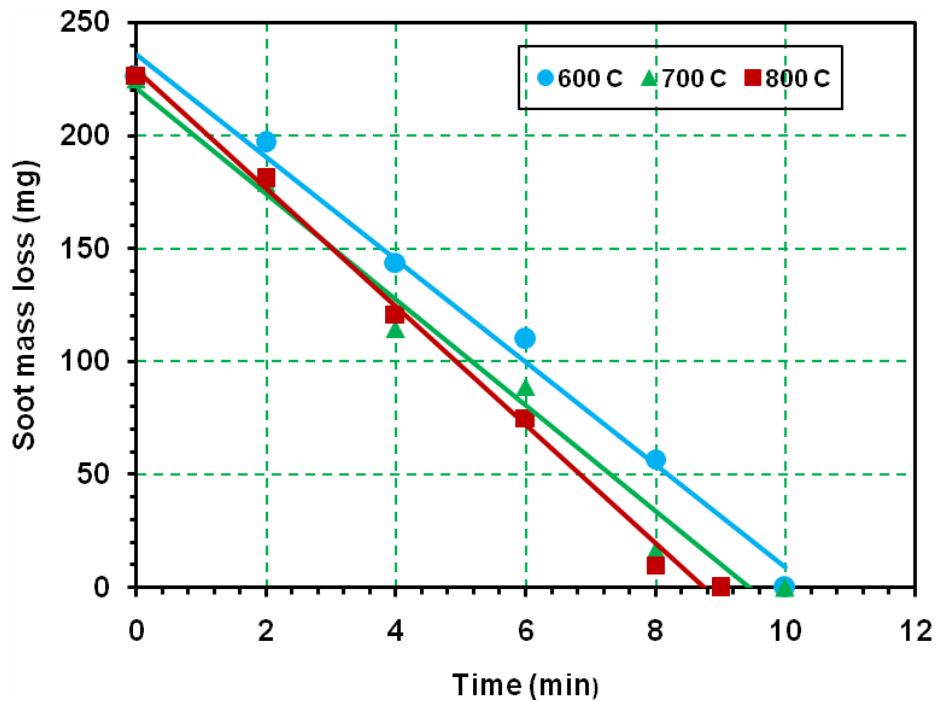
الشكل (6) كتلة السناج المنبعث مع تغير الحمل والسرعة



الشكل (7) نسبة الهواءالوقود مع تغير الحمل والسرعة

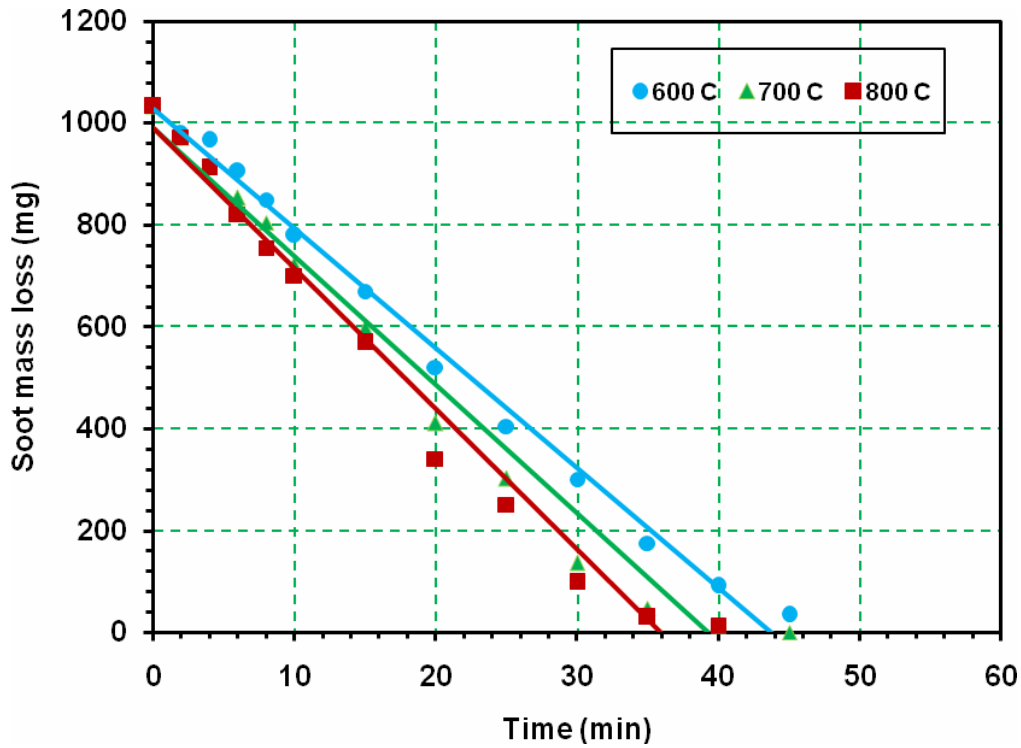


الشكل (8) معالجة السناج بالتسخين شبه الخطي للأحمال العالية والمتوسطة

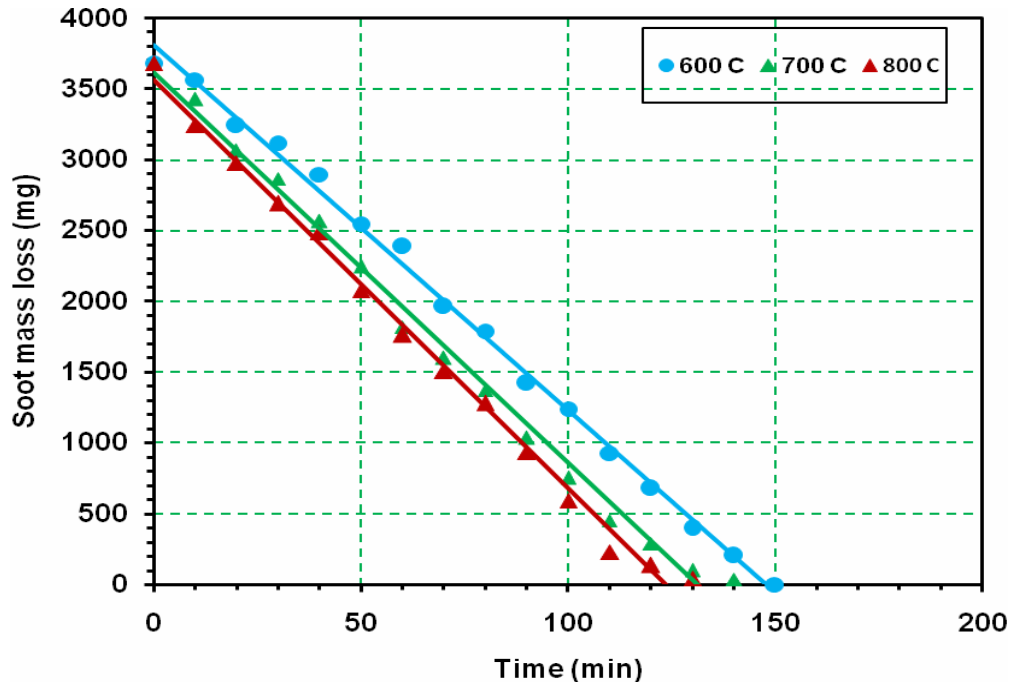




الشكل (9) معالجة السناج بتسخين أيزوثرمل في الاحمال المنخفضة



الشكل (10) معالجة السناج بتسخين أيزوثرمل في الاحمال المتوسطة



الشكل (11) معالجة السناج بتسخين أيزوثرمل في الاحمال العالية

