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%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% ENGR 132
% Program Description
%Using the given data create a figure with a 2x2 subplot that contain
 the
%given data on linear,semilogx,semilogy and loglog scales. Then the
 data is
%linearized to find the best fit equation by using least squares
%regression. Then using this equation answer the given questions.
%
% Assigment Information
%   Assignment:   PS 05, Problem 01
%   Author:    Ranjan Behl, rbehl@purdue.edu
%   Team ID:   008-14
%   Paired Partner:     John Chapla, jchapla@purdue.edu
%   Contributor:  Name, login@purdue [repeat for each]
%   Our contributor(s) helped us:
%     [ ] understand the assignment expectations without
%         telling us how they will approach it.
%     [ ] understand different ways to think about a solution
%         without helping us plan our solution.
%     [ ] think through the meaning of a specific error or
%         bug present in our code without looking at our code.

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

INITIALIZATION

```
Data = csvread("Data_uranium_adsorption.csv",1,0); % loading the given
 data into a martix called Data
uptake = Data(:,2); % the uptake data into a independent column vector
time = Data(:,1); % the time data into a separte column vector
```

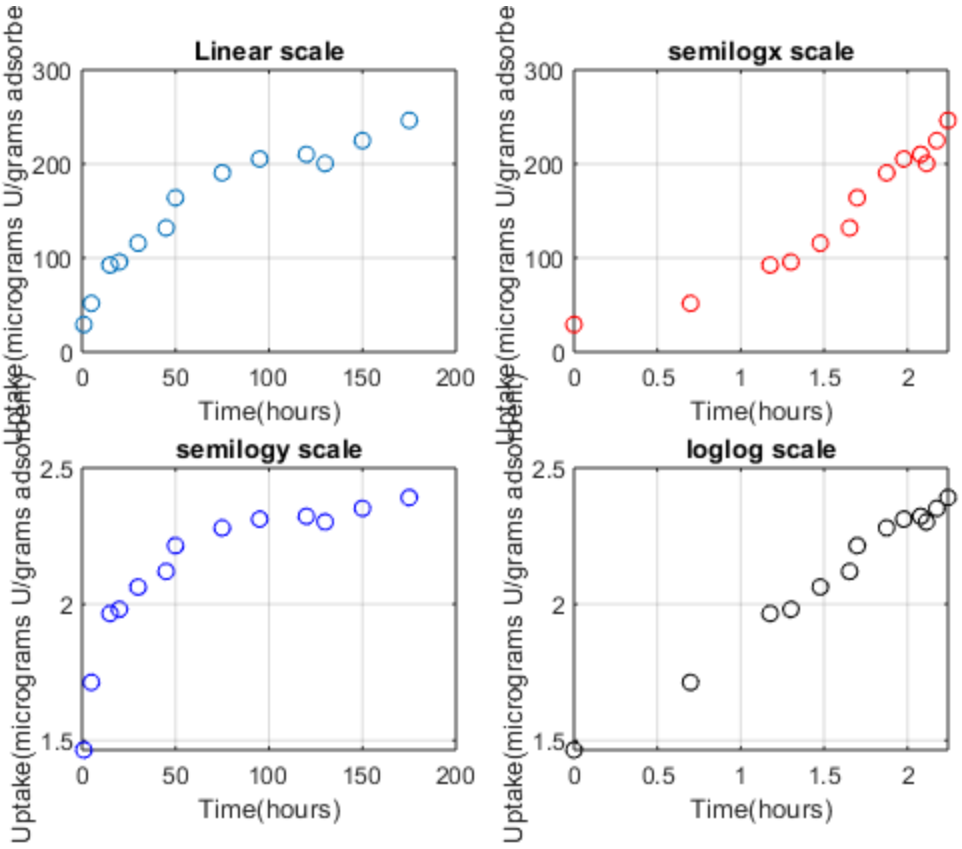
SUBPLOT FIGURE

```
%Part A
figure (1)
subplot(2,2,1);
plot(time,uptake,'o'); % ploting the data on linear scale
grid on
title("Linear scale"); % creating a title
xlabel("Time(hours)"); % labeling the x axis
ylabel("Uptake(micrograms U/grams adsorbent)"); % labeling the y axis

subplot(2,2,2);
plot(log10(time),uptake,'ro');
grid on
title("semilogx scale"); % creating a title
xlabel("Time(hours)"); % labeling the x axis
ylabel("Uptake(micrograms U/grams adsorbent)"); % labeling the y axis

subplot(2,2,3);
plot(time,log10(uptake),'bo');
grid on
title("semilogy scale"); % creating a title
xlabel("Time(hours)"); % labeling the x axis
ylabel("Uptake(micrograms U/grams adsorbent)"); % labeling the y axis

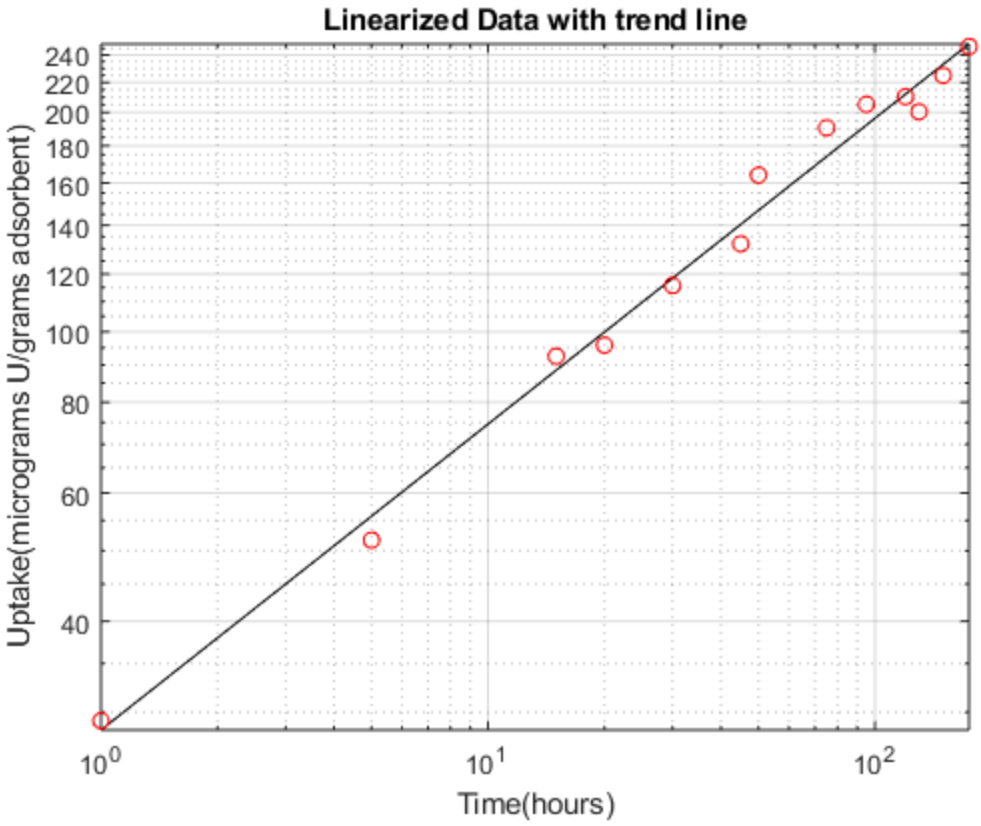
subplot(2,2,4);
plot(log10(time),log10(uptake),'ko');
grid on
title("loglog scale"); % creating a title
xlabel("Time(hours)"); % labeling the x axis
ylabel("Uptake(micrograms U/grams adsorbent)"); % labeling the y axis
```



LINEARIZATION

```
%Part C
coeffiecent_uptake  = polyfit(log10(time),log10(uptake),1); % finding
 the slope and y int of the linear eq
Linearizeddata = 10.^coeffiecent_uptake(2) * time.^
 coeffiecent_uptake(1); %
%
fprintf('\nThe linearized form of the equation is Uptake = %d * time +
 %f',coeffiecent_uptake(:,1),coeffiecent_uptake(:,2));
%
figure (2)
loglog(time,Linearizeddata,'-k'); % ploting the trendline
grid on
hold on
plot(time,uptake,'ro'); % ploting the given data
title("Linearized Data with trend line"); % creating a title
xlabel("Time(hours)"); % labeling the x axis
ylabel("Uptake(micrograms U/grams adsorbent)"); % labeling the y axis
hold off
```

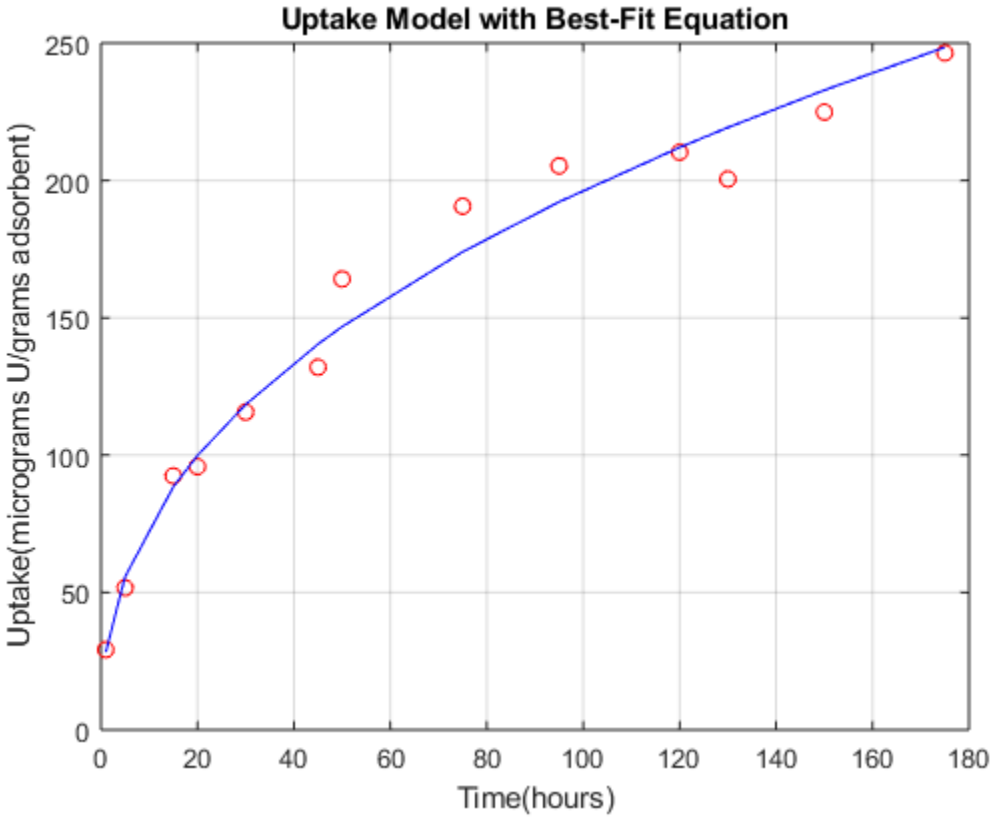
```
The linearized form of the equation is Uptake = 4.202426e-01 * time +
 1.452611
```



UPTAKE MODEL

```
fprintf("\n THe best- fit equation for the relationship is Uptake =
 10^%f * time^%f",coeffiecent_uptake(2),coeffiecent_uptake(1))
%
bestfitdata = 10.^coeffiecent_uptake(2) *
 time.^coeffiecent_uptake(1); % finding the new y values based on the
 best fit eq
figure (3)
plot(time,uptake,'ro');
hold on
grid on
plot((time),bestfitdata,'-b');
title("Uptake Model with Best-Fit Equation"); % creating a title
xlabel("Time(hours)"); % labeling the x axis
ylabel("Uptake(micrograms U/grams adsorbent)"); % labeling the y axis
hold off
```

*THe best- fit equation for the relationship is Uptake = 10^1.452611 * time^0.420243*



PREDICTIONS

```
uptake10 = 10.^coeffiecent_uptake(2) * 10.^coeffiecent_uptake(1); %
 finding the predicted uranium uptake after 10 hours
uptake100 = 10.^coeffiecent_uptake(2) * 100.^coeffiecent_uptake(1); %
 finding the predicted uranium uptake after 100 hours
uptake250 = 10.^coeffiecent_uptake(2) * 250.^coeffiecent_uptake(1); %
 finding the predicted uranium uptake after 250 hours
```

ANALYSIS

-- Q1

The power function(loglog scale) is the one that best represents the relationship between data.

-- Q2

Based on the model the predicted uranium uptake after 10 hours is 74.6197 micrograms U/grams adsorbent, 196.3796 micrograms U/grams adsorbent after 100 hours and 288.6208 micrograms U/grams adsorbent after 250 hours. The main limitation that the lead engineer needs to know about is that the model will become more useless the more it goes away from the given data. For example its not advised to use the model after say 250 hours.

ACADEMIC INTEGRITY STATEMENT

We have not used source code obtained from any other unauthorized source, either modified or unmodified. Neither have we provided access to our code to another. The script we are submitting is our own original work.

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