ANEXO 2: Código Matlab

```
function varargout = Selector(varargin)
% SELECTOR M-file for Selector.fig
%      SELECTOR, by itself, creates a new SELECTOR or raises the existing
%      singleton*.
%
%      H = SELECTOR returns the handle to a new SELECTOR or the handle to
%      the existing singleton*.
%
%      SELECTOR('CALLBACK',hObject,eventData,handles,...) calls the local
%      function named CALLBACK in SELECTOR.M with the given input
arguments.
%
%      SELECTOR('Property','Value',...) creates a new SELECTOR or raises
the
%      existing singleton*.  Starting from the left, property value pairs
are
%      applied to the GUI before Selector_OpeningFcn gets called.  An
%      unrecognized property name or invalid value makes property
application
%      stop.  All inputs are passed to Selector_OpeningFcn via varargin.
%
%      *See GUI Options on GUIDE's Tools menu.  Choose "GUI allows only one
%      instance to run (singleton)".
%
% See also: GUIDE, GUIDATA, GUIHANDLES

% Edit the above text to modify the response to help Selector

% Last Modified by GUIDE v2.5 05-Oct-2013 12:59:31

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @Selector_OpeningFcn, ...
                   'gui_OutputFcn',  @Selector_OutputFcn, ...
                   'gui_LayoutFcn',  [] , ...
                   'gui_Callback',   []);
if nargin && ischar(varargin{1})
    gui_State.gui_Callback = str2func(varargin{1});
end

if nargout
    [varargout{1:nargout}] = gui_mainfcn(gui_State, varargin{:});
else
    gui_mainfcn(gui_State, varargin{:});
end
% End initialization code - DO NOT EDIT


% --- Executes just before Selector is made visible.
function Selector_OpeningFcn(hObject, eventdata, handles, varargin)
% This function has no output args, see OutputFcn.
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
```

```
% varargin   command line arguments to Selector (see VARARGIN)

% Choose default command line output for Selector
handles.output = hObject;

% Update handles structure
guidata(hObject, handles);

% UIWAIT makes Selector wait for user response (see UIRESUME)
% uiwait(handles.figure1);


% --- Outputs from this function are returned to the command line.
function varargout = Selector_OutputFcn(hObject, eventdata, handles)
% varargout  cell array for returning output args (see VARARGOUT);
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Get default command line output from handles structure
varargout{1} = handles.output;


% --- Executes on button press in efec.
function efec_Callback(hObject, eventdata, handles)
T=(0:5:40);
    T1=(T+273)/293;
    Ha=(5.807*10^7).*T.^(-5.88); %mol /m3 atm %constante de henry a T
    figure
    plot(T,Ha)
    title('Cte. Henry para el O2-Agua');
    xlabel('Temperatura ºC');
    ylabel('Cte de henry O2, mol/m3 atm');
    grid on
    figure
    Csr=-0.005657*T+0.403754;%en mol/m3 %según exccel
    plot(T,Csr)
    title('Concentración de Saturacion O2-Agua a T');
    xlabel('Temperatura ºC');
    ylabel('Csr, mol/m3');
    grid on
    figure
    Da1=2.503*10^-5; %difusividad del O2 en agua a 20ºC
    Da=Da1.*(T1.^1.5); %m2/s difisuivadad a T
    plot(T,Da,'r');
    title('Difusividad del O2_Agua');
    xlabel('Temperatura ºC');
    ylabel('Difusividad m2/s');
    grid on
     %Densidad del aire
   roa=-0.3383*log(T)+2.2628;
   figure
   plot(T,roa);
   title('Densidad aire vs T');
    xlabel('Temperatura ºC');
    ylabel('Densidad Kg/m3');
    grid on
% hObject    handle to efec (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
```

```
% handles    structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of efec



function entrada1_Callback(hObject, eventdata, handles)
% hObject    handle to entrada1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of entrada1 as text
%        str2double(get(hObject,'String')) returns contents of entrada1 as
a double


% --- Executes during object creation, after setting all properties.
function entrada1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to entrada1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function entrada2_Callback(hObject, eventdata, handles)
% hObject    handle to entrada2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of entrada2 as text
%        str2double(get(hObject,'String')) returns contents of entrada2 as
a double


% --- Executes during object creation, after setting all properties.
function entrada2_CreateFcn(hObject, eventdata, handles)
% hObject    handle to entrada2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function entrada3_Callback(hObject, eventdata, handles)
% hObject    handle to entrada3 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
```

```
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of entrada3 as text
%        str2double(get(hObject,'String')) returns contents of entrada3 as
a double


% --- Executes during object creation, after setting all properties.
function entrada3_CreateFcn(hObject, eventdata, handles)
% hObject    handle to entrada3 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function salida1_Callback(hObject, eventdata, handles)
% hObject    handle to salida1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of salida1 as text
%        str2double(get(hObject,'String')) returns contents of salida1 as a
double


% --- Executes during object creation, after setting all properties.
function salida1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to salida1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function salida2_Callback(hObject, eventdata, handles)
% hObject    handle to salida2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of salida2 as text
%        str2double(get(hObject,'String')) returns contents of salida2 as a
double


% --- Executes during object creation, after setting all properties.
function salida2_CreateFcn(hObject, eventdata, handles)
```

```
% hObject    handle to salida2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function salida3_Callback(hObject, eventdata, handles)
% hObject    handle to salida3 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of salida3 as text
%        str2double(get(hObject,'String')) returns contents of salida3 as a
double


% --- Executes during object creation, after setting all properties.
function salida3_CreateFcn(hObject, eventdata, handles)
% hObject    handle to salida3 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function salida4_Callback(hObject, eventdata, handles)
% hObject    handle to salida4 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of salida4 as text
%        str2double(get(hObject,'String')) returns contents of salida4 as a
double


% --- Executes during object creation, after setting all properties.
function salida4_CreateFcn(hObject, eventdata, handles)
% hObject    handle to salida4 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
```

```
end



function salida5_Callback(hObject, eventdata, handles)
% hObject    handle to salida5 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of salida5 as text
%        str2double(get(hObject,'String')) returns contents of salida5 as a
double


% --- Executes during object creation, after setting all properties.
function salida5_CreateFcn(hObject, eventdata, handles)
% hObject    handle to salida5 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


% --- Executes on button press in radiobutton2.
function radiobutton2_Callback(hObject, eventdata, handles)
TT=get(handles.entrada1,'String');
T=str2double(TT);
cc=get(handles.entrada2,'String');
c=str2num(cc);
cc0=get(handles.entrada3,'String');
c0=str2double(cc0);
g=9.81;%m/s2
ro=1000;%kg/m^3
pi=3.1416;
y0=0.21;
P=1; %atm
L=0.2683;%m, espesor de 1 capa de relleno
 e=[0.123 0.257 0.515];%indice de huecos [0.257 0.301 0.500]
    h=[0.3884 0.6567 0.925];%m, cota
    em=mean(e);

    deq=[0.051 0.125 0.2];
    dm=mean(deq);
    fi=[0.173 0.356 0.768];
    dp=deq.*fi;
    dpm=mean(dp); %diámetro medio de las particulas

        %volumen de tanque ocupado por el relleno
        r1=0.4375-((0.925-h(1,3))/tan(22*pi/45));
        r2=0.4375-((0.925-h(1,1))/tan(22*pi/45));
        z=h(1,3)-h(1,1);
        vr=(z*pi/3)*(r1^2+r2^2+r1+r2);%volumen del tanque la parte de
relleno
    Vocu=vr*(1-em); %volumen ocupado por el relleno
```

```
    D=2*(0.4375-((0.925-h)/tan(22*pi/45)));%m, diametro tanque
    S=(pi.*D.^2)./4; %m2, superficie tanque
    S=mean(S);

%Una vez el sistema este trabajando en régimen la altura que se tiene

    Qs=7.083*10^-5;%caudal de descarga
    t=[5 10 15 20 25 30 35 40 45 50 55 60];
   %dt=0.016;st=pi*dt^2/4;l1=1.82;l2=25.237;nu=10^-3;
   %Qe=(st^2/ro)*(128*nu*(l1+l2)/
(pi*dt^4)+square((16384*nu^2*(l1+l2+2*l1*l2))/(pi^2*dt^8)-2*ro^2*g*1/st^2))
    Qe=8.15*10^-5;
    v=Qe./(S*em);
    G=3.4e-4.*(S.*(1-em)); %m3/s
    vg=G./(S*em);
    L1=3*L;

%-------------------------------------------------------------------------
T1=(T+273)/293;
   T2=((T+6)+273)/293;
   nu=1.6721.*exp(-0.0234.*T);
   Ha=5.807*10^7.*T^(-5.88); %mol /m3 atm
   Cs=-0.005657.*T+0.403754;%en mol/m3
   Da1=2.503*10^-5;
   Da=Da1.*(T1.^1.5);
    C0=c0/32;%concentración inicial en mol/m3
   %Kla, Kl y a obtenidos
   C=c./32;
   %-----------------------------------------------------------------------
  uu=1;
   while uu<=1
   cc=linspace(0.8*Cs,Cs-0.001,12);
   b=2.3*log((Cs-C0)./(Cs-cc));
   Kla=b./t;
   figure
   plot(cc,Kla)
   grid on
   title('Kl*a vs C');
   xlabel('C mol/m3');
   ylabel('Kl*a m/s');
   Re=ro*v*dm/(nu);
   if Re<=2000
       rey='Régimen laminar';
   else
       rey='Régimen turbulento';
   end
   set(handles.salida9,'String',rey);
   Sc=nu./(ro.*Da);
 Sh=2+0.4*(Re^0.5+0.06*Re^0.667)*Sc^0.4;
  Nu=0.0021*(Re^0.75)*Sc^0.5;
  df=(nu.^2)/(Da.*ro^2);
   Kl=Sh*Da/df;
   as=Kla./Kl;
   Kla=mean(Kla);
   a=mean(as);
   %coef lado gas: despreciable por ser contorlado por resistencia líquido

   %av=6*(1-em)/dpm
```

```
  av=153.012;
  Kl1=Kla/av;
  dif=Kl/Kl1;
  if dif>0.7
      dd='Kl aceptable';
  else
      dd='Kl inaceptable';
  end
  set(handles.salida8,'String',dd);
   uu=uu+1;
   end

   %Arhenius Kl=Kl20*tet^(T-20)

Namax=Kla*(P*y0-Ha*C0)/Ha;% mol/m2 s flujo molar de oxigeno máximo
Ciml=((Cs-C0)-(Cs-C))./(log((Cs-C0)./(Cs-C)));
Nav=Kla.*Ciml;
Na=mean(Nav);
Na1=Kl.*av.*Ciml;%usando coef obetenido por numeros adimensionales y av
Na1=mean(Na1);

na=Na*32*1000; %mg O2/m2 s flujo másico
set(handles.salida1,'String',num2str(Na));
set(handles.salida2,'String',num2str(Na1));
set(handles.salida3,'String',num2str(na));
set(handles.salida4,'String',Kl);
set(handles.salida5,'String',a);
set(handles.salida10,'String',Kla);
%-------------------------------------------------------------------------
C1=linspace(C0,Cs,12);
Ciml1=((Cs-C0)-(Cs-C1))./(log((Cs-C0)./(Cs-C1)));
Na3=Kla.*Ciml1;
Na5=Kl.*av.*Ciml1;
figure
subplot(2,2,1)
plot(C1,Na3);
grid on
title('Na vs Ci');
ylabel('Na mol/m2 s');
xlabel('C mol/m3');
subplot(2,2,2)
plot(C1,Na5,'r');
grid on
title('Na vs Ci');
ylabel('Na mol/m2 s');
xlabel('C mol/m3');
subplot(2,2,3)
plot(C1,Na3);
hold on
plot(C1,Na5,'r');
grid on
title('Na vs Ci');
ylabel('Na mol/m2 s');
xlabel('C mol/m3');
hold off
xlswrite('lecho.xls',T,'hoja1','B3','r+');
xlswrite('lecho.xls',c0,'hoja1','B1','r+');
xlswrite('lecho.xls',Cs,'hoja1','B2','r+');
xlswrite('lecho.xls',c,'hoja1','B6:M6','r+');
```

```
xlswrite('lecho.xls',Nav,'hoja1','B7:M7','r+');
xlswrite('lecho.xls',Na,'hoja1','B10','r+');
xlswrite('lecho.xls',Na1,'hoja1','B11','r+');
xlswrite('lecho.xls',na,'hoja1','B12','r+');
xlswrite('lecho.xls',Kl,'hoja1','B14','r+');
xlswrite('lecho.xls',a,'hoja1','B15','r+');
xlswrite('lecho.xls',Kla,'hoja1','B16','r+');
  xlswrite('lecho.xls',T,'hoja1','B3','r+');

%--------------------------------------------------------------------------
% hObject    handle to radiobutton2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of radiobutton2



function salida6_Callback(hObject, eventdata, handles)
% hObject    handle to salida6 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of salida6 as text
%        str2double(get(hObject,'String')) returns contents of salida6 as a
double


% --- Executes during object creation, after setting all properties.
function salida6_CreateFcn(hObject, eventdata, handles)
% hObject    handle to salida6 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function salida7_Callback(hObject, eventdata, handles)
% hObject    handle to salida7 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of salida7 as text
%        str2double(get(hObject,'String')) returns contents of salida7 as a
double


% --- Executes during object creation, after setting all properties.
function salida7_CreateFcn(hObject, eventdata, handles)
% hObject    handle to salida7 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called
```

```
% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


% --- Executes on button press in radiobutton4.
function radiobutton4_Callback(hObject, eventdata, handles)
TT=get(handles.entrada1,'String');
T=str2double(TT);
g=9.81;%m/s2
ro=1000;%kg/m^3
 nu=1.6721.*exp(-0.0234.*T);
pi=3.1416;
y0=0.21;
P=1; %atm
L=0.2683;%m, espesor de 1 capa de relleno
 e=[0.123 0.257 0.515];%indice de huecos [0.257 0.301 0.500]
    h=[0.3884 0.6567 0.925];%m, cota
    em=mean(e);

    deq=[0.051 0.125 0.2];
    dm=mean(deq);
    fi=[0.173 0.356 0.768];
    dp=deq.*fi;
    dpm=mean(dp); %diámetro medio de las particulas

        %volumen de tanque ocupado por el relleno
        r1=0.4375-((0.925-h(1,3))/tan(22*pi/45));
        r2=0.4375-((0.925-h(1,1))/tan(22*pi/45));
        z=h(1,3)-h(1,1);
        vr=(z*pi/3)*(r1^2+r2^2+r1+r2);%volumen del tanque la parte de
relleno
    Vocu=vr*(1-em); %volumen ocupado por el relleno

    D=2*(0.4375-((0.925-h)/tan(22*pi/45)));%m, diametro tanque
    S=(pi.*D.^2)./4; %m2, superficie tanque
    S=mean(S);

%Una vez el sistema este trabajando en régimen la altura que se tiene

    Qs=7.083*10^-5;%caudal de descarga
    t=[5 10 15 20 25 30 35 40 45 50 55 60];
   %dt=0.016;st=pi*dt^2/4;l1=1.82;l2=25.237;nu=10^-3;
   %Qe=(st^2/ro)*(128*nu*(l1+l2)/
(pi*dt^4)+square((16384*nu^2*(l1+l2+2*l1*l2))/(pi^2*dt^8)-2*ro^2*g*1/st^2))
    Qe=8.15*10^-5;
    v=Qe./(S*em);
    G=3.4e-4.*(S.*(1-em)); %m3/s
    vg=G./(S*em);
    L1=3*L;
    roa=-0.3383.*log(T)+2.2628;
 jj=menu('Seleccione lecho','Superior','Medio','Inferior','Total');

     if jj==1
        e=e(1,3);
        dp=dp(1,3);
```

```
        %'Pérdida carga del líquido en lecho superior'
        p1=(150*nu*v*L*(1-e)^2)/(dp^2*ro*e^3);
        p2=(1.75*v^2*L*(1-e))/(dp*e^3);
        APl=ro*(p1+p2)*1.013e-5;
        APl=APl*10332.556; %mm H2O
        %'Pérdida carga del aire en lecho superior'
        p3=(150*vg*L*(1-e)^2)/(dp^2*roa*e^3);
        p4=(1.75*vg^2*L*(1-e))/(dp*e^3);
        APg=roa*(p3+p4)*1.013e-5; %atm
        APg=APg*10332.556; %mm H2O

    elseif j==2
        e=e(1,2);
        dp=dp(1,2);
       % 'Pérdida carga del líquido en lecho medio'
        p1=(150*nu*v*L*(1-e)^2)/(dp^2*ro*e^3);
        p2=(1.75*v^2*L*(1-e))/(dp*e^3);
        APl=ro*(p1+p2)*1.013e-5;
        APl=APl*10332.556; %mm H2O
        %'Pérdida carga del aire en lecho medio'
        p3=(150*vg*L*(1-e)^2)/(dp^2*roa*e^3);
        p4=(1.75*vg^2*L*(1-e))/(dp*e^3);
        APg=roa*(p3+p4)*1.013e-5; %atm
        APg=APg*10332.556; %mm H2O
    elseif j==3
         e=e(1,2)
         dp=dp(1,1);
         %'Pérdida carga del líquido en lecho inferior'
        p1=(150*nu*v*L*(1-e)^2)/(dp^2*ro*e^3);
        p2=(1.75*v^2*L*(1-e))/(dp*e^3);
        APl=ro*(p1+p2)*1.013e-5;
        APl=APl*10332.556; %mm H2O
        %'Pérdida carga del aire en lecho inferior'
        p3=(150*vg*L1*(1-e(1,1))^2)/(dp^2*roa*e(1,1)^3);
        p4=(1.75*vg^2*L1*(1-e(1,1)))/(dp*e(1,1)^3);
        APg=roa*(p3+p4)*1.013e-5; %atm
        APg=APg*10332.556; %mm H2O

     else
         %Dpm=0.1253;
        %'Pérdida carga del líquido en lecho total'
        p1=(150*nu*v*L1*(1-em)^2)/(dpm^2*ro*em^3);
        p2=(1.75*v.^2*L1*(1-em))/(dpm*em^3);
        APl=ro*(p1+p2)*1.013e-5;
        APl=APl*10332.556; %mm H2O
        %'Pérdida carga del aire en lecho total'
        p3=(150*vg*L1*(1-em)^2)/(dpm^2*roa*em^3);
        p4=(1.75*vg^2*L1*(1-em))/(dpm*em^3);
        APg=roa*(p3+p4)*1.013e-5; %atm
        APg=APg*10332.556; %mm H2O

     end
     set(handles.salida6,'String',APl);
     set(handles.salida7,'String',APg);
     xlswrite('lecho.xls',T,'hoja1','B3');
     xlswrite('lecho.xls',APl,'hoja1','B18');
     xlswrite('lecho.xls',APg,'hoja1','B19');
```

```
% hObject    handle to radiobutton4 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of radiobutton4



function salida8_Callback(hObject, eventdata, handles)
% hObject    handle to salida8 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of salida8 as text
%        str2double(get(hObject,'String')) returns contents of salida8 as a
double


% --- Executes during object creation, after setting all properties.
function salida8_CreateFcn(hObject, eventdata, handles)
% hObject    handle to salida8 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function salida9_Callback(hObject, eventdata, handles)
% hObject    handle to salida9 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of salida9 as text
%        str2double(get(hObject,'String')) returns contents of salida9 as a
double


% --- Executes during object creation, after setting all properties.
function salida9_CreateFcn(hObject, eventdata, handles)
% hObject    handle to salida9 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end

function salida10_Callback(hObject, eventdata, handles)
% hObject    handle to salida10 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
```

```
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of salida10 as text
%        str2double(get(hObject,'String')) returns contents of salida10 as
a double


% --- Executes during object creation, after setting all properties.
function salida10_CreateFcn(hObject, eventdata, handles)
% hObject    handle to salida10 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


% --------------------------------------------------------------------
function ayuda_Callback(hObject, eventdata, handles)
% hObject    handle to ayuda (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% --------------------------------------------------------------------
function Untitled_2_Callback(hObject, eventdata, handles)
% hObject    handle to Untitled_2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% --------------------------------------------------------------------
function abrir_ayuda_Callback(hObject, eventdata, handles)
winopen('AYUDA.pdf');
% hObject    handle to abrir_ayuda (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% --- Executes on button press in pushbutton1.
function pushbutton1_Callback(hObject, eventdata, handles)
set(handles.entrada1,'string',' ');
set(handles.entrada2,'string',' ');
set(handles.entrada3,'string',' ');
set(handles.salida1,'string',' ');
set(handles.salida2,'string',' ');
set(handles.salida3,'string',' ');
set(handles.salida4,'string',' ');
set(handles.salida5,'string',' ');
set(handles.salida6,'string',' ');
set(handles.salida7,'string',' ');
set(handles.salida8,'string',' ');
set(handles.salida9,'string',' ');
set(handles.salida10,'string',' ');
% hObject    handle to pushbutton1 (see GCBO)
```

```
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% --------------------------------------------------------------------
function credit_Callback(hObject, eventdata, handles)
figdiag=figure('Units','Pixels','Position',[1420 1420 1420 1420],...
    'Number','off','Name','Créditos','Menubar','none','color','k');
%Ubicamos ejes en figura
axes('Units','Normalized','Position',[0 0 1 1]);
%-----Centramos la figura---------
scrsz = get(0, 'ScreenSize');
pos_act=get(gcf,'Position');
xr=scrsz(3) - pos_act(3);
xp=round(xr/2);
yr=scrsz(4) - pos_act(4);
yp=round(yr/2);
set(gcf,'Position',[xp yp pos_act(3) pos_act(4)]);
%--------------------------------------
%Incluir imagen
%Importamos imagen *.jpg,junto con su mapa de colores
[x,map]=imread('foto.jpg','jpg');
%Representamos imagen en figura, con su mapa de colores
image(x),colormap(map),axis off,hold on
%Títulos sobre imagen
%Título
text(400,150,'Modelado de Aireación de un Lecho Bacteriano Piloto',...
'Fontname','Arial','Fontsize',36,'Fontangle','Italic','Fontweight','Bold','
color','w');
text(1100,350,'Proyecto Final de Máster en Ingeniería Ambiental',...
    'Fontname','Comic Sans
MS','Fontangle','Italic','Fontweight','Bold','Fontsize',20,'color','w');
text(1250,2300,'Alberto Martín Llorente - Ingeniro Químico',...
    'Fontname','Comic Sans
MS','Fontangle','Italic','Fontweight','Bold','Fontsize',16,'color','r');
text(1250,2500,'Contacto: martinllorente.alberto@gmail.com',...
    'Fontname','Comic Sans
MS','Fontangle','Italic','Fontweight','Bold','Fontsize',16,'color','r');
%Botón Continuar
botok=uicontrol('Style','pushbutton','Units','normalized','Position',[.84 .
03 .12 .05],'String','CONTINUAR','Callback','clear
all;close;clc;Selector');
uiwait
% hObject    handle to credit (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% --- Executes on selection change in popupmenu1.
function popupmenu1_Callback(hObject, eventdata, handles)
% hObject    handle to popupmenu1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: contents = get(hObject,'String') returns popupmenu1 contents as
cell array
%        contents{get(hObject,'Value')} returns selected item from
popupmenu1
```

```
% --- Executes during object creation, after setting all properties.
function popupmenu1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to popupmenu1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: popupmenu controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc &&
isequal(get(hObject,'BackgroundColor'),get(0,'defaultUicontrolBackgroundCol
or'))
    set(hObject,'BackgroundColor','white');
end


% --- Executes on button press in checkbox1.
function checkbox1_Callback(hObject, eventdata, handles)
% hObject    handle to checkbox1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of checkbox1


% --------------------------------------------------------------------
function Untitled_1_Callback(hObject, eventdata, handles)
% hObject    handle to Untitled_1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% --------------------------------------------------------------------
function esq_Callback(hObject, eventdata, handles)
figdiag=figure('Units','Pixels','Position',[1420 1420 1420 1420],...
 'Number','off','Name','Esquema_del_sistema','Menubar','none','color','k');
%Ubicamos ejes en figura
axes('Units','Normalized','Position',[0 0 1 1]);
%-----Centramos la figura---------
scrsz = get(0, 'ScreenSize');
pos_act=get(gcf,'Position');
xr=scrsz(3) - pos_act(3);
xp=round(xr/2);
yr=scrsz(4) - pos_act(4);
yp=round(yr/2);
set(gcf,'Position',[xp yp pos_act(3) pos_act(4)]);
%-------------------------------------
%Incluir imagen
%Importamos imagen *.jpg,junto con su mapa de colores
[x,map]=imread('Dibujo.jpg','jpg');
%Representamos imagen en figura, con su mapa de colores
image(x),colormap(map),axis off,hold on
%Botón Continuar
botok=uicontrol('Style','pushbutton','Units','normalized','Position',...
    [.84 .03 .12 .05],'String','CONTINUAR','Callback','clear
all;close;clc;Selector');
uiwait

% hObject    handle to esq (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
```

```
% handles    structure with handles and user data (see GUIDATA)


% --------------------------------------------------------------------
function Untitled_3_Callback(hObject, eventdata, handles)
figdiag=figure('Units','Pixels','Position',[1420 1420 1420 1420],...

'Number','off','Name','Corte_del_sistema','Menubar','none','color','k');
%Ubicamos ejes en figura
axes('Units','Normalized','Position',[0 0 1 1]);
%-----Centramos la figura---------
scrsz = get(0, 'ScreenSize');
pos_act=get(gcf,'Position');
xr=scrsz(3) - pos_act(3);
xp=round(xr/2);
yr=scrsz(4) - pos_act(4);
yp=round(yr/2);
set(gcf,'Position',[xp yp pos_act(3) pos_act(4)]);
%--------------------------------------
%Incluir imagen
%Importamos imagen *.jpg,junto con su mapa de colores
[x,map]=imread('corte.jpg','jpg');
%Representamos imagen en figura, con su mapa de colores
image(x),colormap(map),axis off,hold on
%Botón Continuar
botok=uicontrol('Style','pushbutton','Units','normalized','Position',...
[.84 .03 .12 .05],'String','CONTINUAR','Callback','clear all;close
;clc;Selector');
uiwait
% hObject    handle to Untitled_3 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% --- Executes on button press in excel.
function excel_Callback(hObject, eventdata, handles)
winopen('lecho.xls');
% hObject    handle to excel (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% --- Executes during object creation, after setting all properties.
function data_CreateFcn(hObject, eventdata, handles)
% hObject    handle to data (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end
```