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ICT Tool : Development of Calculator for Design of Solar Dryer

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ABSTRACT

Henry David said "Men Have Become the Tools of Their Tools." In this era all the developing technology begin from calculation influenced by the computer programming ICT-tool. Today energy is main problem, by utilizing sun light energy(solar energy) problem can be minimize. Sun drying is still the most common method used to preserve agricultural products in most tropical and subtropical countries. However, being unprotected from rain, wind-borne dirt and dust, infestation by insects, rodents and other animal, products may be seriously degraded to the extent that sometimes become inedible and the resulted loss of food quality in the dried products may have adverse economic effects on domestics and international markets. The conditions in tropical countries make the use of solar energy for drying food practically attractive and environmentally sound. Dryers have been developed and used to dry agricultural products in order to improve shelf life. Solar drying facilities are economical for small holders, especially under favourable meteorological conditions. This paper discuss to design to calculate design of solar dryer. In this different parameters are determined i.e Moisture removed, Water activity, Equilibrium Relative humidity, Total Heat Needed, Enthalpy, Average Drying rate, Drying time, Collector area, Length of air vent, Velocity required. The calculator was developed using C language Version 3.0 Turbo c++ copyright (c)1990, 1992 by Borland International was developed.

Keyword- ICT tool, Solar Dryer , drying rate ,velocity.

INTRODUCTION

Henry David said "Men Have Become the Tools of Their Tools." In this era all the developing technology begin from calculation influenced by the ICT-tool. Today energy is main problem, by utilizing sun light energy problem can be minimize. Sun drying is still the most common method used to preserve agricultural products in most tropical and subtropical countries. However, being unprotected from rain, wind-borne dirt and dust, infestation by insects, rodents and other animal, products may be seriously degraded to the extent that sometimes become inedible and the resulted loss of food quality in the dried products may have adverse economic effects on domestics and international markets. The conditions in tropical countries make the use of solar energy for drying food practically attractive

and environmentally sound. Dryers have been developed and used to dry agricultural products in order to improve shelf life. Solar drying facilities are economical for small holders, especially under favorable meteorological conditions.

This paper discuss to Calculator for Design of Solar Dryer. In this different parameters are determined i.e Moisture removed, Water activity, Equillibrium Relative humidity, Total Heat Needed , Enthalpy, Average Drying rate, Drying time, Collector area, Length of air vent , Velocity required. The calculator was developed using C language Version 3.0 Turbo C++ copyright (c)1990, 1992 by Borland International was developed.

MATERIALS AND METHODS

With the design of soar dryer. It includes different formulae and theoretical considerations those are used while developing the calculator. It also encapsulates the configuration of the system and information about the used to develop calculator.

Configuration of the System

Desktop System :- Intel® Pentium® 4, 2.0 GHz , 1 GB DDR 2-RAM , Intel 845 Series Motherboard, Microsoft®Windows™ XP Professional

About the platform

ICT tool - Development of Calculator for Design of Solar Dryer using C language Version 3.0 Turbo c++ copyright (c)1990, 1992 by Borland International, Inc. following different formulae are used.

Design Features of the Dryer

Solar Dryer Design Considerations, Design procedure, Design Calculations. To carry out design calculations and size of the dryer, the design conditions applicable.

Moisture removed

mw = mp(Mi – Mf) / (100- Mf)

Final or equilibrium relative humidity

aw = 1- exp[-exp(0.914+0.5639lnM)]

Quantity of heat needed to evaporate the H_2O

Q = mw x hfg (4)

hfg = 4.186*103(597-0.56(Tpr)) (5)

h = 1006.9T +w[2512131.0 +1552.4T]

Average drying rate

mdr = mw/ td

m‘= mdr / [wf –wi]

Aclç = E = m‘ (hf -hi)td

Ac=E/(I*ç)

Air vent dimensions

Av = Va/Vw

Bv = Av/Lv

Required pressure

Velocity = Va/A

‘C’ program-Source Code for Solar Dryer Calculator

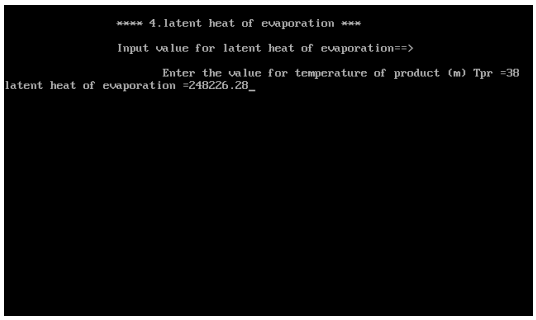
```
// program was developed by Dr P R kolhe , Dr BSKKV Dapoli,  Pradip p kolhe Dr PDKV akola
#include <stdio.h>
#include<math.h>
#include<conio.h>
void main()
{
floatmw,mp,mi,mf ,  aw,m ,ln,  ERH ,  hfg,Tpr  , Q,mdr ,wf,wi,td,E,hf,hi ,  Ac,I,n ,  Av,Va,Vw; float Lv,Bv ,  V;
  intkk, choice =0 ;
          while (choice!=13)
          {
clrscr();
          printf(“\n\t\t\t**** DEPARTMENT OF EOES***\n”);
          printf(“\t\t\t~~~~~~~~~~~~~~~~~~~~~~~~~~~~\n”);
          printf(“\tDevelopment of Solar Dryer \n\n”);
          printf(“\tA.To calculate Design of Dryer for mango slice  \n”);
          printf(“\t\t  1.moisture removed  \n”);
          printf(“\t\t  2.water activity \n”);
          printf(“\t\t  3.equillibrium relative humidity\n”);
          printf(“\t\t  4.latent heat of evaporation \n\n”);
```

```
        printf("\t\t  5.quantity of heat needed \n");
        printf("\t\t  6.average drying rate \n");
        printf("\t\t  7. drying time\n");
        printf("\t\t  8.Total heat energy \n");
        printf("\t\t  9. collector area\n");
        printf("\t\t  10.air vent area \n");
        printf("\t\t  11. length of air vent\n");
        printf("\t\t  12. velocity\n");
        printf("\t\t  13.EXIT \n");
        printf("\n\t ENTER YOUR CHOICE <1
-13>");
        scanf("%d",&choice);

switch (choice)
{
case 1:             /* moisture removed*/
   {
clrscr();
        printf("\n\t\t **** 1.moisture removed ***\n\
");
        scanf("%f",&mi);
        printf("\t\t\tEnter value of final moisture
content(m) \ mf=");
        scanf("%f",&mf);
        printf("\t\t\tEnter value of mass of
product(m) \mp=");
        scanf("%f",&mp);
        mw= mp*(mi-mf)/(100-mf);
        printf(" moisture removed =%5.2f",mw);
                getch();
        break;      }
case 2 :            /* water activity*/
   {
clrscr();
        printf("\n\t\t **** 2.water activit  ***\n\ ");
        scanf("%f",&m);
        aw=1-exp(-exp(0.914+0.5639*ln* (m))) ;
        printf(" water activity =%5.2f",aw);
        /*For print press print key*/
        getch();
        break;    }
        case 3 :            /* equillibrium relative
humidity*/
   {
clrscr();
        scanf("%f",&aw);
          ERH = aw*100 ;
        printf("equillibrium relative humidit
=%5.2f",ERH);
        /*For print press print key*/
getch(); break;     }
        case 4 :            /* latent heat of
evaporation*/
   {
clrscr();
        printf("\n\t\t **** 4.latent heat of evaporation
***\n\ ");

        scanf("%f",&Tpr);
        hfg=4.186*103 *(597-(0.56*(Tpr)));
        printf("latent heat of evaporation =%5.2f",
hfg);
        /*For print press print key*/
getch(); break;
     }
        case 5 :            /* quantity of heat
needed*/
   {
clrscr();
        printf("\n\t\t **** 5.quantity of heat needed
***\n\ ");
        scanf("%f",&hfg);
                scanf("%f",& mw);
          Q=mw*hfg;
        printf(" quantity of heat needed =%5.2f",
Q);
        /*For print press print key*/
getch();break;      }
case 6 :            /* average drying rate*/
   {
clrscr();
        printf("\n\t\t **** 6.average drying rate ***\n\
");
                scanf("%f",&wf);
                scanf("%f",&wi);
                scanf("%f",& m);
        mdr=m*(wf-wi);
        printf(" average drying rate
=%5.2f",mdr);
        /*For print press print key*/
getch();break;      }
case 7 :            /* drying time*/
   {
printf("\n\t\t ****7 . drying time ***\n\ ");
        scanf("%f",& mw);
        scanf("%f",&mdr);
        td=mw/mdr;
        printf(" drying time =%5.2f",td);
        /*For print press print key*/
getch();break;      }
```

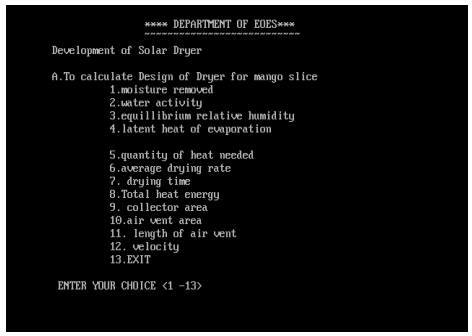
```
        case 8 :            /* total heat energy*/
   {
printf("\n\t\t ****8 .total heat energy ***\n\ ");
        scanf("%f",&hf);
                scanf("%f",& hi);
                scanf("%f",& td);
                scanf("%f",&mp);
        E=mp*(hf-hi)*td;
                /*For print press print key*/
getch();break;      }
```

```
case 9 :            /* collector area*/
   {
printf("\n\t\t ****9 .collector area ***\n\ ");
        scanf("%f",& E);
        scanf("%f",& I);
        scanf("%f",& n);
         Ac=E/( I*n);
                /*For print press print key*/
getch();break;      }
```

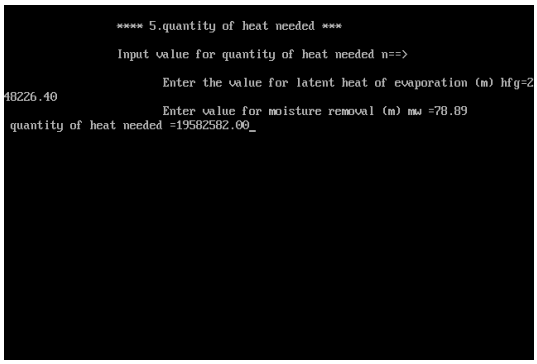
Output screen for Calculator



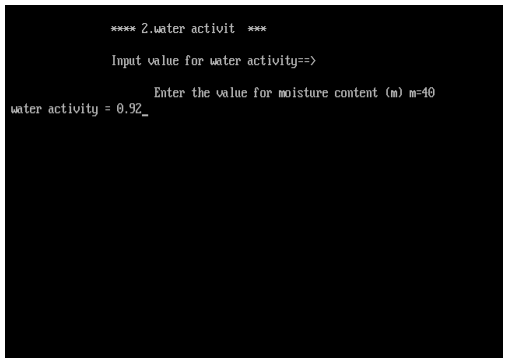
output for latent heat of evaporation



Main page: Option window

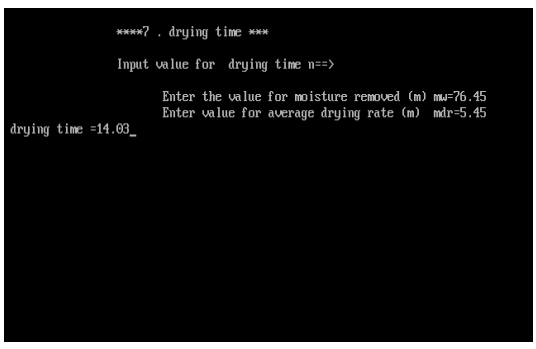


output for quantity of heat needed



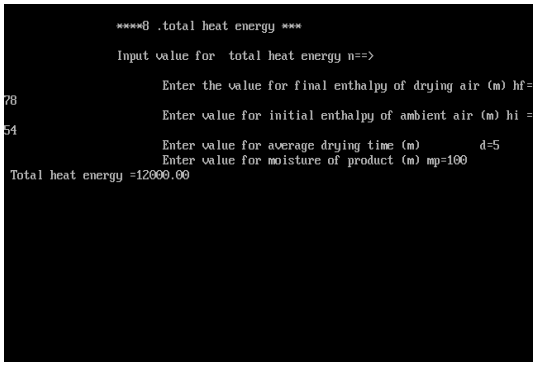
output for water activity

output for average drying rate

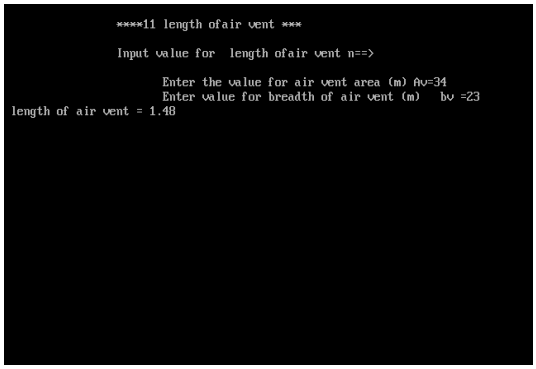


output for drying time

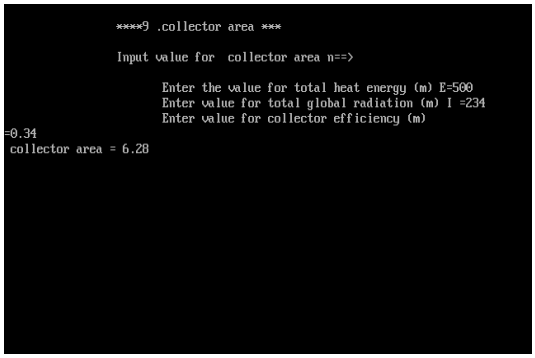
output for Air vent area



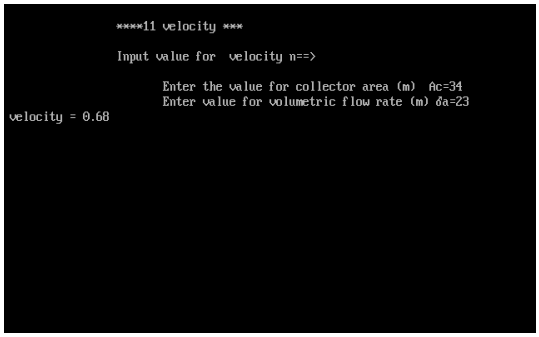
output for total heat energy



output for Length of air vent



output for collector area



output for velocity

RESULTS AND DISCUSSION

This deals with the guideline to use ICT tool - Development of Calculator for Design of Solar Dryer. The programme is prepared in the C language Version 3.0 Turbo c++.

How to use

Enter the option from 1 to 13 for which you want to estimate the flow.

1. Give the input values.
2. After pressing enter key, output will be displayed.

3. Again press the enter key to switch over to the main page.
4. Follow the same procedure to calculate the flow of any other devices those are included on the main page.

The programme is tested for representative values of inputs for all fourteen structures. Results obtained are as follows:

CONCLUSIONS

1. System is platform independent.
2. This is calculated to design of solar dryer.
3. Calculator is user friendly.
4. Calculated values were found nearest to that of on-paper calculations.

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