บรรณานุกรม

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ภาคผนวก

ภาคผนวก ก-1

ภาคผนวกนี้แสดงโปรแกรมคอมพิวเตอร์และลักษณะการกระจายความชื้นในชั้นมันสำปะหลังหนา 40 ซม. ของทั้งการคำนวณและการทดลอง สำหรับทั้งกรณีการอบแห้งแบบปกติและการอบแห้งโดยผสมวัสดุเป็นครั้งคราว (ในที่นี้จะแสดงตัวอย่างของกรณีที่ผสมวัสดุทุก ๆ 50 นาที)

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//DBAL4444 JOB          KAMONRAT PHANRAYA
      DIMENSION ZTA(200),REXPER(200),ETA(100),FI(100),RCAL(200),A(50),A
     *TA(50),TIME(100),WEXP(20,10),A(100),YA(50),AEXP(20,10)
C  CA=INITIAL MOISTURE CONTENT (KG WATER/ KG DRY SOLID)(THIN BED EXP)
C  CB=FINAL MOISTURE CONTENT(KG WATER/ KG DRY SOLID)(THIN BED EXP)
C  EC=EQUILIBRIUM MOISTURE CONTENT(KG WATER/KG DRY SOLID)
C  DEN=DENSITY (KG/CUBIC M)
C  ZTA(I)=DISTANCE (CM)
C  BTA(I)=DISTANCE (DIMENSIONLESS)
C  BTAL= BED HEIGHT(DIMENSIONLESS)
C  CCMASS=MASS TRANSFER COEFFICIENT(KG/CUBIC M.HR.DELTA H)
C  AFSION=FRACTION OF VOL OCCUPIED BY DRY MATERIAL IN PACKED BED
C        =1-(VOID FRACTION)
C  CONA,CONB,CONC=CONSTANT VALUE IN RATE OF DRYING FORMULA
C  CCON=INITIAL VALUE OF CRITICAL MOISTURE CONTENT USED IN TRIAL AND ERROR
C  CALCULATION TO FIND OPTIMUM CRITICAL MOISTURE CONTENT
C  CCDIFF=INTERVAL OF CRITICAL MOISTURE CONTENT TO BE VARIED
C  CCOFF=FINAL VALUE OF CRITICAL MOISTURE CONTENT USED IN TRIAL AND ERROR
C  CALCULATION TO FIND OPTIMUM CRITICAL MOISTURE CONTENT
C  NUMBER=NUMBER OF DATA FROM THE EXPERIMENT (THIN BED EXP)
C  ZTA(I)=TIME(HR) (THIN BED EXP)
C  A(I)=MOISTURE CONTENT THAT CORRESPONDED WITH ZTA(I) (THIN BED EXP)
C  REXPER=RATE OF DRYING FROM THE EXPERIMENT (THIN BED EXP)
C  FI=VALUE OF MOISTURE CONTENT OF AIR AT WET BULB TEMPERATURE MINUS VALUE OF
C  MOISTURE CONTENT OF AIR BEFORE ENTER THE BED
C  FLOW=MASS FLOW RATE (KG DRY AIR/HR. SQUARE M)
C  MPOINT=NUMBER OF COLUMN OF DATA (MOISTURE CONTENT) FROM THE LONG BED EXP
C  (DIRECT FLOW OR MIXING) PLUS COLUMN OF TIME AND AVERAGE MOISTURE CONTENT
C  LPOINT=NUMBER OF COLUMN OF DATA (MOISTURE CONTENT) FROM THE LONG BED EXP
C  (DIRECT FLOW OR MIXING) PLUS COLUMN OF TIME
C  NATA=NUMBER OF ROW OF DATA(TIME) FROM THE LONG BED EXP(DIRECT FLOW)
C  MATA=NUMBER OF ROW OF DATA(TIME) FROM THE LONG BED EXP(MIXING)
C  NPOINT=NUMBER OF CALCULATION OF THE PROFILE OF MOISTURE CONTENT IN LONG BED
C  BEFORE EACH MIXING.
C        =MIXING TIME INTERVAL DEVIDED BY TIME INTERVAL OF EACH CALCULATION
C  OF PROFILE
C  ZTADI=TIME INTERVAL OF EACH CALCULATION OF PROFILE OF MOISTURE CONTENT
C  XMIX=FINAL VALUE OF MIXING TIME INTERVAL
C  WEXP(I,J)=VALUE OF MOISTURE CONTENT OF THE DRYING MATERIAL IN THE BED AT
C  DIFFERENT HEIGHT IN CASE OF DIRECT FLOW EXP
C  AEXP(I,J)=VALUE OF MOISTURE CONTENT OF THE DRYING MATERIAL IN THE BED AT
C  DIFFERENT HEIGHT IN CASE OF MIXING EXP
C  TIME(I)=VALUE OF TIME(MIN) FROM THE EXPERIMENT(LONG BED EXP)
      READ(5,66)CA,CB,EC,CONA,CONB,CONC,DEN,ETAL,CCMASS,AFSION
   66 FORMAT(8F10.3)
      WRITE(6,101)
  101 FORMAT(1H1)
      WRITE(6,67)CA,CB,EC,CONA,CONB,CONC,DEN,ETAL,CCMASS,AFSION
   67 FORMAT(/2X,'  CA=',F10.5,2X,'  CB=',F10.5,2X,'  EC=',F10.5,2X,
     *'  CONA=',F10.5,2X,'  CONB=',F10.5,2X,'  CONC=',F10.5//2X,'  DEN=
     *',F10.5,'  ETAL=',F10.5,2X,'  CCMASS=',F15.5,2X,'  AFSION=',F10.5)
      READ (5,10) CCON,CCDIFF,CCOFF,NUMBER
   10 FORMAT(3F5.2,I10)
      READ (5,20) (ZTA(I),I=1,NUMBER)
   20 FORMAT(8F5.3)
      WRITE(6,22)(ZTA(I),I=1,NUMBER)
   22 FORMAT(//7(' THETA=',F10.3))
      READ(5,12) (A(I),I=1,NUMBER)
   12 FORMAT(16F5.3)
      WRITE(6,13)(A(I),I=1,NUMBER)
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      17      12 FORMAT(/7('MOISTURE=',F10.3))
      18         READ (5,20) (REXPER(I),I=1,NUMBER)
      19      20 FORMAT(8F5.3)
      20         WRITE(6,33)(REXPER(I),I=1,NUMBER)
      21      33 FORMAT(/7(' REXPER=',F10.3))
      22         READ(5,40) PI,FLOW,MPOINT,NATA,LPOINT,MATA
      23      40 FORMAT(2F8.4,4I10)
      24         WRITE(6,11) PI,FLOW,MPOINT,NATA,LPOINT,MATA
      25      11 FORMAT(/2X,'PI=',F6.4,2X,'MASSFLOWRATE=',F10.2,2X,'MPOINT=',I10,2X
             *,'NATA=',I10,2X,'LPOINT=',I10,2X,'MATA=',I10)
      26         READ(5,18)(TIME(I),I=1,NATA)
      27      18 FORMAT(12F5.1)
      28         READ(5,16)(DATA(J),J=3,MPOINT)
      29      16 FORMAT(10F5.3)
      30         READ(5,17)((WEXP(I,J),J=1,LPOINT),I=1,NATA)
      31      17 FORMAT(9F8.4)
      32         READ(5,60) MPOINT,XMIX,ZTADI
      33      60 FORMAT(I10,2F10.6)
      34         READ(5,150)((AEXP(I,J),J=1,LPOINT),I=1,MATA)
      35     150 FORMAT(9F8.4)
             C      WRITE & SHOW DATA FROM THE EXPERIMENT
      36         WRITE(6,101)
      37         WRITE(6,41)(DATA(J),J=3,MPOINT)
      38      41 FORMAT(50X,'TABLE OF RAW DATA BETWEEN TIME & MOISTURE'///2X,'TIME(
             *(MIN)   *    *      *',30X,'VALUE OF MOISTURE AT DISTANCE(CM)=',2C
             *X,'MEAN'//25X,'*',2X,8F10.5///)
      39         DO 7 I=1,NATA
      40         WEXP(I,MPOINT)=(WEXP(I,2)+WEXP(I,3)+WEXP(I,4)+WEXP(I,5)+WEXP(I,6)+
             *WEXP(I,7)+WEXP(I,8)+WEXP(I,9))/8.
      41       7 CONTINUE
      42         WRITE(6,42)((WEXP(I,J),J=1,MPOINT),I=1,NATA)
      43      42 FORMAT(2X,F7.2,19X,9F10.5)
             C WRITE DATA FOR CALCULATION CC MINIMUM
      44         WRITE (6,70) CCON,CCDIFF,CCOFF,NUMBER
      45      70 FORMAT(//54X,'CALCULATION VAULE OF CC'//5X,'CC ON=',F10.5,5X,
             *'CC DIFFERENT=',F10.5,5X,'CC OFF=',F10.5,5X,'NUMBER OF THETA=',
             *I5)
             C CALCULATION CC
      46         CC = CCON
      47         SUMMIN = 1.0E6
      48     222 EXPCC=EXP(CONA/(CC-EC))
      49         SUM = 0.0
      50         DO 44 I=1,NUMBER
      51         EXPZTA=EXP(CONB*ZTA(I)/(CC-EC))
      52         RCAL(I)=CONC*EXPZTA*(1.0-EXPCC)/(1.0-EXPZTA*(1.0-EXPCC))
      53         RDIFF = REXPER(I)-RCAL(I)
      54         SUM = SUM+RDIFF*RDIFF
      55      44 CONTINUE
      56         IF (SUM.GT.SUMMIN) GO TO 111
      57         SUMMIN = SUM
      58         CCMIN = CC
      59     111 IF(CC.GT.CCOFF) GO TO 333
      60         CC = CC+CCDIFF
      61         GO TO 222
             C WRITE VALUE OF CALCULATION FROM CC MINIMUM
      62     333 WRITE (6,80) SUMMIN,CCMIN
      63      80 FORMAT(//10X,'SUMMATION=',F10.5,3X,'CC MINIMUM=',F10.5/)
      64         WRITE(6,90)
      65      90 FORMAT(10X,'THETA(PI)',20X,'RATE OF EXPERIMENT',20X,'RATE OF CALCU
             *LATION')
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      EXPCC=EXP(CCNA/(CCMIN-EC))
      DO 100 I=1,NUMBER
      EXPZTA=EXP(CCNA*ZTA(I)/(CCMIN-EC))
      FCAL(I)=CONC*EXPZTA*(1.0-EXPCC)/(1.0-EXPZTA*(1.0-EXPCC))
      WRITE (6,110) ZTA(I),EXPER(I),FCAL(I)
  110 FORMAT (10X,F9.5,20X,F18.9,20X,F18.9)
  100 CONTINUE
C     WRITE * SHOW DATA FROM THE EXPERIMENT IN DIMENSIONLESS FORM
      DO 4 I=1,NATA
      DO 4 J=2,LPOINT
      WEXP(I,J)=(WEXP(I,J))/CCMIN
    4 CONTINUE
      CCA=(WEXP(1,2)+WEXP(1,3)+WEXP(1,4)+WEXP(1,5)+WEXP(1,6)+WEXP(1,7)+W
     *EXP(1,8)+WEXP(1,9))/8.
      DO 23 J=3,MPOINT
      ETA(J)=ATA(J)*COMASS/100./FLOW
   23 CONTINUE
      WRITE(6,101)
      WRITE(6,55) CCMIN
   55 FORMAT(/5X,'CCMIN=',F6.2//)
      DO 3 I=1,NATA
      WEXP(I,10)=(WEXP(I,2)+WEXP(I,3)+WEXP(I,4)+WEXP(I,5)+WEXP(I,6)+WEXP
     *(I,7)+WEXP(I,8)+WEXP(I,9))/8.
    3 CONTINUE
      WRITE(6,24)(ETA(J),J=3,MPOINT)
   24 FORMAT(/50X,'TABLE OF DATA IN DIMENSIONLESS'///2X,'TIME(MIN)  TAU
     *       ',35X,'VALUE OF FI AT ETA=',32X,' FI MEAN'//25X,'*',8F10.5/
     *///)
      WRITE(6,52)((WEXP(I,J),J=1,MPOINT),I=1,NATA)
   52 FORMAT(2X,F7.2,17X,9F10.5)
C     SHOW DATA FROM CALCULATION
      WRITE(6,101)
      FIONA=CCA
      WRITE(6,108) FIONA
  108 FORMAT(5X,'FIONA=',F8.4)
      WRITE(6,25)(ETA(J),J=3,MPOINT)
   25 FORMAT(/50X,'TABLE OF DATA IN DIMENSIONLESS'///2X,'TIME(MIN)  TAU
     *       ',35X,'VALUE OF FI AT ETA=',32X,' FI MEAN',3X,'RATE'//25X,'
     **',8F10.5///)
      TF=5.
      TUF=COMASS*TF/(AFSION*DEN*CCMIN*60.)
      TUT=0.
      TG=0.
   56 W=EXP(PI*TUT)
      I=3
   57 A(I)=FIONA*(EXP(FIONA*ETA(I)))/(W+EXP(FIONA*ETA(I))-1)
      I=I+1
      IF(I.GT.MPOINT) GO TO 58
      GO TO 57
   58 C=EXP((-FIONA)*ETAL)
      E=EXP((FIONA)*ETAL)
      D=EXP(-PI*TUT)
      BA=(FIONA*ETAL+ALOG(D*(1.-C)+C))/ETAL
      RATE=((PI*FIONA*C*(1.-E))/(ETAL*(FIONA-(FIONA*C)+(FIONA*D*E))))*(CC
     *MASS/(AFSION*DEN))
      WRITE(6,61) TG,TUT,(A(I),I=3,MPOINT),BA,RATE
   61 FORMAT(2X,F7.2,2X,F9.2,7X,'(F10.5)
      IF(A(MPOINT).LT.0.9999) GO TO 5
      TUT=TUT+TUF
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      GO TO 56
C     WRITE&SHOW DATA FROM THE EXPERIMENT IN CASE OF MIXING
    5 WRITE(6,'(1)')
      WRITE(6,151)(ATA(J),J=3,MPOINT)
  151 FORMAT(50X,'TABLE OF B/W DATA BETWEEN TIME&MOISTURE  IN CASE OF MI
     *XING'///2X,'TIME(MIN)    *     *       *',20X,'VALUE OF MOISTURE AT
     *DISTANCE(CM)=',20X,'MEAN'//25X,'*',2X,9F10.5///)
      DO 152 I=1,MATA
      AEXP(I,MATA)=(AEXP(I,2)+AEXP(I,3)+AEXP(I,4)+AEXP(I,5)+AEXP(I,6)+AE
     *XP(I,7)+AEXP(I,8)+AEXP(I,9))/8.
  152 CONTINUE
      WRITE(6,153)((AEXP(I,J),J=1,MPOINT),I=1,MATA)
  153 FORMAT(2X,F7.2,19X,9F10.5)
C     WRITE&SHOW DATA IN DIMENSIONLESS FORM IN CASE OF MIXING
      DO 154 I=1,MATA
      DO 154 J=2,MPOINT
      AEXP(I,J)=(AEXP(I,J))/CCMIN
  154 CONTINUE
      ACA=(AEXP(1,2)+AEXP(1,3)+AEXP(1,4)+AEXP(1,5)+AEXP(1,6)+AEXP(1,7)+A
     *EXP(1,8)+AEXP(1,9))/8.
      DO 155 J=3,MPOINT
      ETA(J)=ATA(J)*COMASS/100./FLOW
  155 CONTINUE
      WRITE(6,101)
      WRITE(6,156) CCMIN
  156 FORMAT(/5X,'CCMIN=',F6.2//)
      DO 157 I=1,MATA
      AEXP(I,10)=(AEXP(I,2)+AEXP(I,3)+AEXP(I,4)+AEXP(I,5)+AEXP(I,6)+AEXP
     *(I,7)+AEXP(I,8)+AEXP(I,9))/8.
  157 CONTINUE
      WRITE(6,158)(ETA(J),J=3,MPOINT)
  158 FORMAT(/50X,'TABLE OF DATA IN DIMENSIONLESS IN CASE OF MIXING'///2
     *X,'TIME(MIN)   TAU       ',25X,'VALUE OF FI AT ETA=',32X,'FI MEAN'
     *//25X,'*',8F10.5///)
      WRITE(6,159)((AEXP(I,J),J=1,MPOINT),I=1,MATA)
  159 FORMAT(2X,F7.2,17X,9F10.5)
      FIGNAA=ACA
      I=1
      J=3
  113 YA(I)=ETA(J)
      I=I+1
      J=J+1
      IF(J.GT.MPOINT) GO TO 51
      GO TO 113
   51 I=1
   14 ETA(I)=YA(I)
      I=I+1
      IF(I.GT.8) GO TO 551
      GO TO 14
  551 MPOINT=8
      ZTAON=0.0000
      ZTADF=1000.
      IPOINT = MPOINT
      MPOINT = 0
 2222 MPOINT = MPOINT+IPOINT
      ZTAMIX = FLOAT(MPOINT)*ZTADI
      FIGN=FIGNAA
      WRITE(6,104)
  104 FORMAT(1H1)
      WRITE(6,63) MPOINT,ZTADI,XMIX,FIX
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      63 FORMAT(/2X,' NPOINT=',I2,'  ZTADI=',F10.5,'  XMIX=',F10.5,'  FIX='
     *,F10.5)
      WRITE(6,166)ZTAMIX
  166 FORMAT(//10X,'$$$$$$$$$$$$$$$   MIXING EVERY ',F10.2,' MIN $$$$$$')
C WRITE TYPING OF CALCULATION FOR PROFILE AFTER MIXING
      WRITE(6,160)(ETA(I),I=1,MPOINT)
  160 FORMAT(/35X,'TABLE OF CALCULATION FOR PROFILE AFTER MIXING'///'   T
     *HETA(MIN)  *      TAU      *',4CX,'VAULE OF FI AT ETA='/'   SUM
     * NONSUM*   SUM   NONSUM*',10F10.5//)
      WRITE (6,106)
  106 FORMAT(1HO)
C CALCUTION FOR PROFILE AFTER MIXING
      THETA =ZTAON
      ZTASUM = ZTAON
      DO 170 K=1,MPOINT
      FI(K)=FION
  170 CONTINUE
      TAUSUM = 0.0
  888 TAU = 0.0
      N = 0
  777 WRITE (6,180) ZTASUM,THETA,TAUSUM,TAU,(FI(K),K=1,MPOINT)
  180 FORMAT(1X,F7.2,1X,F7.2,'*',F7.2,F8.2,'*',10F10.5)
      FIOFF=0.00001
      IF (FI(MPOINT).LT.FIOFF) GO TO 666
      IF (ZTASUM.GT.ZTAOFF) GO TO 666
      IF (N.EQ.NPOINT) GO TO 999
      THETA = THETA+ZTADI
      ZTASUM=ZTASUM+ZTADI
      N =N+1
      TAU=COMASS*THETA/(AFSION*DEN*(CCMIN-EC)*60.0)
      TAUSUM=ZTASUM*COMASS/(AFSION*DEN*(CCMIN-EC)*60.0)
      AE=EXP(PI*TAU)
      DO 190 K=1,MPOINT
      B= EXP(FION*ETA(K))
      FI(K)=FION*B/(AE+(B-1.0))
  190 CONTINUE
      GO TO 777
  999 C=EXP((-FION)*ETAL)
      D=EXP((-PI)*TAU)
      FION=(FION*ETAL+ALOG(D*(1.0-C)+C))/ETAL
      THETA = ZTAON
      WRITE(6,105)
  105 FORMAT(1HO)
      DO 3333 IJ=1,MPOINT
      FI(IJ) = FION
 3333 CONTINUE
      GO TO 888
  666 IF(ZTAMIX.GT.XMIX) GO TO 1111
      GO TO 2222
 1111 STOP
      END

$ENTRY
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```
 CA=   0.80000    CB=   0.00000    EC=   0.00000    CONA=   3.06000    CONP= -10.71000    CONC=  -2.30400

 DEN= 924.12980  ETAL=  30.53000    CCMASS= 162626.00000    APSICN=  0.23000

THETA=     0.000   THETA=     0.117   THETA=     0.183   THETA=     0.283   THETA=     0.400   THETA=     0.567   THETA=     0.800
THETA=     1.133   THETA=

CISTURE=   0.800MOISTURE=   0.700MOISTURE=   0.600MOISTURE=   0.500MOISTURE=   0.400MOISTURE=   0.300MOISTURE=   0.200
CISTURE=   0.100MOISTURE=

REXPER=    1.624  REXPER=    1.382  REXPER=    1.095  REXPER=    0.900  REXPER=    0.708  REXPER=    0.539  REXPER=    0.360
REXPER=    0.224  REXPER=

PI=0.0140  MASSFLOWRATE=  2130.00  MPOINT=       10  NATA=       20  LPOINT=        9  MATA=       10
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TABLE OF RAW DATA BETWEEN TIME & MOISTURE

TIME(MIN)	*	*	*	VALUE OF MOISTURE AT DISTANCE(CM)=								MEAN
			*	2.50000	7.50000	12.50000	17.50000	22.50000	27.50000	32.50000	37.50000	
0.00				1.66100	1.67600	1.66700	1.70400	1.68500	1.67900	1.66300	1.68600	1.67762
30.00				0.66700	1.33000	1.57600	1.68300	1.67300	1.67900	1.65800	1.67000	1.49200
60.00				0.23100	0.71900	1.28600	1.58500	1.63100	1.63600	1.62600	1.63200	1.29325
90.00				0.06500	0.27800	0.75000	1.35100	1.56000	1.61400	1.60500	1.61600	1.10487
120.00				0.02700	0.08600	0.30500	0.81200	1.32700	1.53300	1.57200	1.57900	0.90500
165.00				0.01600	0.02700	0.07000	0.22900	0.56300	1.05200	1.40600	1.51900	0.61025
195.00				0.00900	0.01600	0.03800	0.09300	0.26500	0.62500	1.13300	1.42200	0.45012
225.00				0.00500	0.00500	0.02100	0.04000	0.09900	0.27600	0.62100	1.10100	0.27100
255.00				0.00000	0.00500	0.01100	0.02200	0.03800	0.10400	0.29300	0.67700	0.14375
285.00				0.00000	0.00500	0.00500	0.01600	0.01600	0.04100	0.12000	0.31900	0.06525
305.00				0.00000	0.00500	0.00500	0.00500	0.01100	0.01200	0.04000	0.13500	0.02750
335.00				0.00000	0.00000	0.00500	0.00500	0.00600	0.01400	0.01300	0.05400	0.01212
395.00				0.00000	0.00000	0.00000	0.00500	0.00000	0.00000	0.00000	0.00500	0.00125
425.00				0.00000	0.00000	0.00000	0.00500	0.00000	0.00000	0.00000	0.00500	0.00125
455.00				0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
485.00				0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
515.00				0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
545.00				0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
575.00				0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
605.00				0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

CALCULATION VAULE OF CC

CC ON= 0.90000 CC DIFFERENT= 0.05000 CC OFF= 10.00000 NUMBER OF THETA= 8

SUMMATION= 0.04747 CC MINIMUM= 3.84996

THETA(HR)	RATE OF EXPERIMENT	RATE OF CALCULATION
0.00000	1.623999000	1.537529000
0.11700	1.381999000	1.309927000
0.18300	1.095000000	1.182901000
0.28300	0.899999900	0.997869600
0.40000	0.708000000	0.799710500
0.56700	0.538999900	0.562116200
0.80000	0.360000000	0.325071800
1.13300	0.223999900	0.138419000

CCMIL= 3.85

TABLE OF DATA IN DIMENSIONLESS

TIME(MIN)	TAU	VALUE OF FI AT ETA=								FI MEAN
	*	1.90876	5.72627	9.54378	13.36129	17.17879	20.99631	24.81381	28.63133	
0.00		0.43143	0.43533	0.43299	0.44260	0.43767	0.43611	0.43195	0.43793	0.43575
30.00		0.17325	0.24546	0.40936	0.43715	0.43455	0.43611	0.43065	0.43377	0.38754
60.00		0.06000	0.18676	0.33403	0.41169	0.42364	0.42494	0.42234	0.42390	0.33591
90.00		0.01688	0.07221	0.19481	0.35091	0.40520	0.41923	0.41689	0.41975	0.28698
120.00		0.00701	0.02234	0.07922	0.21091	0.34468	0.39819	0.40832	0.40987	0.23507
150.00		0.00416	0.00701	0.01818	0.05948	0.14624	0.27325	0.36520	0.38435	0.15851
175.00		0.00234	0.00416	0.00987	0.02416	0.06883	0.16234	0.29429	0.36935	0.11692
225.00		0.00130	0.00130	0.00545	0.01039	0.02571	0.07169	0.16130	0.28598	0.07039
255.00		0.00000	0.00130	0.00286	0.00571	0.00987	0.02701	0.07610	0.17595	0.03734
285.00		0.00000	0.00130	0.00130	0.00416	0.00416	0.01065	0.03117	0.08296	0.01695
305.00		0.00000	0.00130	0.00130	0.00130	0.00286	0.00494	0.01039	0.03507	0.00714
335.00		0.00000	0.00000	0.00130	0.00130	0.00156	0.00364	0.00338	0.01403	0.00315
375.00		0.00000	0.00000	0.00000	0.00130	0.00000	0.00000	0.00000	0.00130	0.00032
425.00		0.00000	0.00000	0.00000	0.00130	0.00000	0.00000	0.00000	0.00130	0.00032
455.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
495.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
515.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
545.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
575.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
605.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

ETMA= C.4355

TABLE OF DATA IN DIMENSIONLESS

TIME(MIN)	TAU	*	VALUE OF FI AT ETA= 1.90876	5.72627	9.54378	13.36129	17.17879	20.99631	24.81381	28.63133	FI MEAN	RATE
0.00	0.00		0.43575	0.43575	0.43575	0.43575	0.43575	0.43575	0.43575	0.43575	0.43575	-0.35086
5.00	16.56		C.39131	C.42657	0.43398	C.43542	0.43569	0.43574	0.43575	0.43575	0.42816	-0.35086
10.00	33.12		C.34671	0.41553	0.43177	0.43499	0.43561	0.43572	0.43575	0.43575	0.42056	-0.35086
15.00	49.68		C.30315	0.40240	0.42901	0.43446	0.43551	0.43570	0.43574	0.43575	0.41297	-0.35086
20.00	66.24		C.26169	C.38698	0.42559	0.43379	0.43539	0.43568	0.43574	0.43575	0.40537	-0.35086
25.00	82.81		0.22320	0.36915	C.42135	0.43295	C.43522	0.43565	0.43573	0.43575	0.39778	-0.35086
30.00	99.37		C.18828	0.34887	0.41612	0.43189	0.43501	0.43561	0.43572	0.43575	0.39019	-0.35085
35.00	115.93		C.15726	0.32627	C.40970	0.43056	0.43476	0.43556	0.43572	0.43574	0.38259	-0.35085
40.00	132.49		0.13021	C.30164	0.40189	0.42891	0.43444	0.43550	0.43570	0.43574	0.37500	-0.35085
45.00	149.05		C.10700	0.27542	C.39246	0.42683	0.43403	0.43542	0.43569	0.43574	0.36740	-0.35085
50.00	165.61		C.08736	0.24821	0.38118	0.42424	0.43352	0.43533	0.43567	0.43574	0.35981	-0.35085
55.00	182.17		C.07095	0.22072	0.36785	0.42102	0.43288	0.43520	0.43565	0.43573	0.35221	-0.35085
60.00	198.73		C.05736	0.19267	C.35231	0.41704	0.43208	0.43505	0.43562	0.43573	0.34462	-0.35085
65.00	215.30		0.04620	C.16774	0.33449	0.41211	0.43107	0.43486	0.43558	0.43572	0.33703	-0.35084
70.00	231.86		C.03710	0.14352	C.31444	C.40607	0.42980	0.43461	0.43553	0.43571	0.32943	-0.35084
75.00	248.42		C.02972	0.12141	0.29234	C.39869	0.42821	0.43430	0.43548	0.43570	0.32184	-0.35084
80.00	264.98		C.02376	0.10167	C.26855	C.38977	C.42622	0.43391	0.43540	0.43563	0.31424	-0.35083
85.00	281.54		C.01896	0.08457	C.24355	0.37907	C.42375	0.43342	0.43531	0.43567	0.30665	-0.35083
90.00	298.10		C.01511	0.06946	0.21796	0.36639	0.42066	0.43281	0.43519	0.43564	0.29906	-0.35082
95.00	314.66		0.01204	0.05681	0.19247	C.35155	0.41684	0.43204	0.43504	0.43562	0.29146	-0.35081
100.00	331.22		C.00958	0.04619	0.16773	0.33448	0.41211	0.43107	0.43486	0.43559	0.28387	-0.35080
105.00	347.78		C.00761	0.03739	0.14434	0.31518	C.40630	0.42985	0.43462	0.43554	0.27628	-0.35078
110.00	364.35		C.00605	0.03014	0.12275	0.29381	0.39921	0.42832	0.43432	0.43548	0.26868	-0.35076
115.00	380.91		C.00481	0.02422	0.10328	C.27066	0.39061	0.42641	0.43395	0.43541	0.26109	-0.35074
120.00	397.47		C.00382	0.01941	0.08606	0.24620	0.38028	0.42403	0.43348	0.43532	0.25350	-0.35070
125.00	414.03		C.00303	0.01553	0.07111	0.22102	0.36800	0.42106	0.43289	0.43521	0.24591	-0.35066
130.00	430.59		C.00240	0.01240	C.05834	0.19577	C.35362	0.41738	0.43215	0.43506	0.23832	-0.35061
135.00	447.15		C.00191	0.00985	0.04756	0.17112	0.33700	0.41283	0.43121	0.43483	0.23073	-0.35055
140.00	463.71		0.00151	0.00787	0.03858	0.14767	0.31815	0.40723	0.43004	0.43466	0.22315	-0.35047
145.00	480.27		C.00120	0.00627	0.03116	0.12592	0.29719	0.40038	0.42858	0.43437	0.21556	-0.35037
150.00	496.83		C.00095	0.00498	0.02507	0.10619	0.27440	0.39207	0.42674	0.43402	0.20798	-0.35024
155.00	513.39		C.00076	0.00396	C.02012	0.08867	0.25020	0.38206	0.42445	0.43356	0.20040	-0.35008
160.00	529.96		C.00060	0.00315	0.01611	0.07341	0.22516	0.37015	0.42159	0.43300	0.19282	-0.34988
165.00	546.52		C.00048	0.00250	0.01287	C.06031	0.19993	0.35616	0.41805	0.43223	0.18525	-0.34963
170.00	563.08		C.00038	C.00198	0.01027	0.04924	C.17518	0.33994	0.41366	0.43119	0.17769	-0.34931
175.00	579.64		C.00030	0.00157	C.00818	0.03998	0.15153	0.32149	0.40826	0.43025	0.17013	-0.34891
180.00	596.20		C.00024	0.00125	C.00652	0.03232	0.12949	0.30090	0.40165	0.42885	0.16258	-0.34841
185.00	612.76		C.00019	0.00099	0.00518	C.02603	0.10941	0.27841	0.39360	0.42709	0.15505	-0.34777
190.00	629.32		C.00015	0.00079	0.00412	0.02090	0.09153	0.25444	0.38391	0.42488	0.14753	-0.34698
195.00	645.88		C.00012	0.00062	C.00327	C.01674	0.07588	0.22951	0.37235	0.42213	0.14003	-0.34598
200.00	662.44		C.00009	0.00050	0.00260	C.01338	0.06243	0.20428	0.35873	0.41872	0.13255	-0.34473
205.00	679.01		C.00007	0.00039	C.00206	C.01068	0.05102	0.17941	0.34292	0.41449	0.12511	-0.34316
210.00	695.57		C.00006	0.00031	0.00164	0.00851	0.04147	0.15553	0.32486	0.40923	0.11770	-0.34121
215.00	712.13		C.00005	0.00025	C.00130	0.00678	0.03355	0.13318	0.30462	0.40287	0.11034	-0.33878
220.00	728.69		C.00004	0.00020	C.00103	0.00539	0.02703	0.11275	0.28245	0.39512	0.10304	-0.33576
225.00	745.25		C.00003	0.00016	C.00082	C.00428	0.02172	0.09448	0.25870	0.38573	0.09581	-0.33208
230.00	761.81		C.00002	C.00012	C.00065	C.00341	0.01740	0.07945	0.23390	0.37451	0.08867	-0.32765
235.00	778.37		C.00002	0.00010	C.00052	C.00271	C.01392	0.06462	0.20867	0.36125	0.08164	-0.32184

240.00	794.93	0.00001	0.00008	0.00041	0.00215	0.01111	0.05287	0.18369	0.34534	0.07475	-0.31504
245.00	811.48	0.00001	0.00006	0.00032	0.00171	0.00886	0.04301	0.15960	0.32317	0.06902	-0.30687
250.00	828.05	0.00001	0.00005	0.00026	0.00135	0.00705	0.03482	0.13696	0.30330	0.06148	-0.29715
255.00	844.62	0.00001	0.00004	0.00020	0.00107	0.00561	0.02808	0.11617	0.28544	0.05516	-0.28574
260.00	861.18	0.00001	0.00003	0.00016	0.00085	0.00446	0.02257	0.09751	0.26293	0.04912	-0.27254
265.00	877.74	0.00000	0.00002	0.00013	0.00068	0.00355	0.01807	0.08109	0.23329	0.04339	-0.25754
270.00	894.30	0.00000	0.00002	0.00010	0.00054	0.00282	0.01447	0.06688	0.21309	0.03798	-0.24083
275.00	910.86	0.00000	0.00002	0.00008	0.00043	0.00224	0.01156	0.05478	0.19301	0.03296	-0.22261
280.00	927.42	0.00000	0.00001	0.00006	0.00034	0.00178	0.00922	0.04461	0.16372	0.02835	-0.20323
285.00	943.98	0.00000	0.00001	0.00005	0.00027	0.00141	0.00734	0.03614	0.14079	0.02417	-0.18312
290.00	960.54	0.00000	0.00001	0.00004	0.00021	0.00112	0.00584	0.02916	0.11965	0.02043	-0.16281
295.00	977.10	0.00000	0.00001	0.00003	0.00017	0.00086	0.00465	0.02345	0.10061	0.01712	-0.14283
300.00	993.66	0.00000	0.00000	0.00003	0.00013	0.00070	0.00369	0.01881	0.08379	0.01424	-0.12370
305.00	1010.23	0.00000	0.00000	0.00002	0.00011	0.00056	0.00293	0.01505	0.06921	0.01176	-0.10582
310.00	1026.79	0.00000	0.00000	0.00002	0.00008	0.00044	0.00233	0.01202	0.05675	0.00965	-0.08951
315.00	1043.35	0.00000	0.00000	0.00001	0.00007	0.00035	0.00185	0.00959	0.04625	0.00787	-0.07494
320.00	1059.91	0.00000	0.00000	0.00001	0.00005	0.00028	0.00147	0.00764	0.03751	0.00639	-0.06218
325.00	1076.47	0.00000	0.00000	0.00001	0.00004	0.00022	0.00117	0.00608	0.03028	0.00517	-0.05119
330.00	1093.03	0.00000	0.00000	0.00001	0.00003	0.00018	0.00092	0.00484	0.02437	0.00416	-0.04186
335.00	1109.59	0.00000	0.00000	0.00000	0.00003	0.00014	0.00073	0.00384	0.01955	0.00334	-0.03404
340.00	1126.15	0.00000	0.00000	0.00000	0.00002	0.00011	0.00058	0.00305	0.01565	0.00268	-0.02755
345.00	1142.71	0.00000	0.00000	0.00000	0.00002	0.00009	0.00046	0.00243	0.01250	0.00214	-0.02221
350.00	1159.28	0.00000	0.00000	0.00000	0.00001	0.00007	0.00037	0.00193	0.00998	0.00171	-0.01785
355.00	1175.84	0.00000	0.00000	0.00000	0.00001	0.00006	0.00029	0.00153	0.00795	0.00136	-0.01430
360.00	1192.40	0.00000	0.00000	0.00000	0.00001	0.00004	0.00023	0.00121	0.00633	0.00109	-0.01144
365.00	1208.96	0.00000	0.00000	0.00000	0.00001	0.00003	0.00018	0.00096	0.00503	0.00086	-0.00913
370.00	1225.52	0.00000	0.00000	0.00000	0.00001	0.00003	0.00014	0.00076	0.00400	0.00069	-0.00728
375.00	1242.08	0.00000	0.00000	0.00000	0.00000	0.00002	0.00011	0.00061	0.00313	0.00055	-0.00580
380.00	1258.64	0.00000	0.00000	0.00000	0.00000	0.00002	0.00009	0.00048	0.00253	0.00043	-0.00462
385.00	1275.20	0.00000	0.00000	0.00000	0.00000	0.00001	0.00007	0.00038	0.00201	0.00034	-0.00367
390.00	1291.76	0.00000	0.00000	0.00000	0.00000	0.00001	0.00006	0.00030	0.00159	0.00027	-0.00292
395.00	1308.32	0.00000	0.00000	0.00000	0.00000	0.00001	0.00005	0.00024	0.00126	0.00022	-0.00232
400.00	1324.89	0.00000	0.00000	0.00000	0.00000	0.00001	0.00004	0.00019	0.00100	0.00017	-0.00184
405.00	1341.45	0.00000	0.00000	0.00000	0.00000	0.00001	0.00003	0.00015	0.00080	0.00014	-0.00146
410.00	1358.01	0.00000	0.00000	0.00000	0.00000	0.00000	0.00002	0.00012	0.00063	0.00011	-0.00116
415.00	1374.57	0.00000	0.00000	0.00000	0.00000	0.00000	0.00002	0.00009	0.00051	0.00009	-0.00092
420.00	1391.13	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00008	0.00040	0.00007	-0.00073
425.00	1407.69	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00006	0.00032	0.00005	-0.00058
430.00	1424.25	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00005	0.00025	0.00004	-0.00046
435.00	1440.81	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00004	0.00020	0.00003	-0.00036
440.00	1457.37	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00003	0.00016	0.00003	-0.00029
445.00	1473.93	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00002	0.00012	0.00002	-0.00023
450.00	1490.50	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00002	0.00010	0.00002	-0.00018
455.00	1507.06	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00008	0.00001	-0.00014
460.00	1523.62	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00006	0.00001	-0.00011
465.00	1540.18	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00005	0.00001	-0.00009
470.00	1556.74	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00004	0.00001	-0.00007
475.00	1573.30	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00003	0.00001	-0.00006
480.00	1589.86	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00002	0.00000	-0.00005
485.00	1606.42	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00002	0.00000	-0.00004
490.00	1622.98	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00002	0.00000	-0.00003
495.00	1639.55	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000	-0.00002
500.00	1656.11	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000	-0.00002

TABLE OF RAW DATA BETWEEN TIME&MOISTURE IN CASE OF MIXING

TIME(MIN) *	*	*	VALUE OF MOISTURE AT DISTANCE(CM)=							MEAN
	*	2.50000	7.50000	12.50000	17.50000	22.50000	27.50000	32.50000	37.50000	
0.00		1.65200	1.69800	1.65200	1.65200	1.64100	1.64100	1.64400	1.62400	1.65050
75.00		0.09700	0.48000	1.16600	1.46500	1.56500	1.59200	1.60100	1.54700	1.18912
150.00		0.02700	0.03200	0.09900	0.38800	0.93500	1.33900	1.49000	1.45600	0.72075
0.00		0.71400	0.71100	0.71400	0.71400	0.70700	0.70700	0.70900	0.69600	0.70900
75.00		0.03200	0.05500	0.10700	0.19600	0.33900	0.47700	0.58400	0.61200	0.30025
150.00		0.00200	0.00800	0.02600	0.01300	0.00500	0.02900	0.04800	0.13200	0.03287
0.00		0.02900	0.02800	0.02900	0.02900	0.02500	0.02500	0.02700	0.01900	0.02637
20.00		0.00700	0.00700	0.01100	0.01100	0.01100	0.01100	0.01300	0.01300	0.01050
40.00		0.00500	0.00300	0.00300	0.00500	0.00300	0.00700	0.00700	0.00500	0.00475
60.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

CC MIN= 3.05

TABLE OF DATA IN DIMENSIONLESS IN CASE OF MIXING

TIME(MIN)	TAU	VALUE OF FI AT ETA=								FI MEAN
	*	1.90876	5.72627	9.54378	13.36129	17.17879	20.99631	24.81381	28.63133	
0.00		0.42910	0.44104	0.42910	0.42910	0.42624	0.42624	0.42702	0.42192	0.42871
75.00		0.02520	0.12468	0.30286	0.38052	0.40650	0.41351	0.41585	0.40132	0.30887
150.00		0.00701	0.00831	0.02571	0.10078	0.24286	0.34780	0.38702	0.37319	0.18721
0.00		0.18546	0.18468	0.18546	0.18546	0.18364	0.18364	0.18416	0.18078	0.18416
75.00		0.00831	0.01429	0.02779	0.05091	0.08805	0.12390	0.15169	0.15396	0.07799
150.00		0.00052	0.00208	0.00675	0.00338	0.00130	0.00753	0.01247	0.03429	0.00854
0.00		0.00753	0.00727	0.00753	0.00753	0.00649	0.00649	0.00701	0.00494	0.00685
20.00		0.00182	0.00182	0.00286	0.00286	0.00286	0.00286	0.00338	0.00338	0.00273
40.00		0.00130	0.00078	0.00078	0.00130	0.00078	0.00182	0.00182	0.00130	0.00123
60.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

NPOINT= 2 ZSTART= 25.00000 XMIX= 450.00000 FIX=UUUUUUUUUU

$$$$$$$$$$$$$ MIXING EVERY 50.00 MIN $$$$$$

TABLE OF CALCULATION FOR PROFILE AFTER MIXING

THETA(MIN) SUM	* NONSUM*	TAU SUM	* NONSUM*	VAULE OF FI AT ETA= 1.90876	5.72627	9.54378	13.36129	17.17879	20.99631	24.81381	28.63133
0.00	0.00*	0.00	0.00*	0.42871	0.42871	0.42871	0.42871	0.42871	0.42871	0.42871	0.42871
25.00	25.00*	82.81	82.81*	0.21815	0.36091	0.41358	0.42568	0.42811	0.42859	0.42869	0.42870
50.00	50.00*	165.61	165.61*	0.08503	0.23994	0.37178	0.41630	0.42623	0.42822	0.42861	0.42869
50.00	0.00*	165.61	0.00*	0.35276	0.35276	0.35276	0.35276	0.35276	0.35276	0.35276	0.35276
75.00	25.00*	248.42	82.81*	0.16673	0.27342	0.32800	0.34597	0.35097	0.35229	0.35264	0.35273
100.00	50.00*	331.22	165.61*	0.06219	0.15924	0.26804	0.32596	0.34538	0.35081	0.35225	0.35263
100.00	0.00*	331.22	0.00*	0.27682	0.27682	0.27682	0.27682	0.27682	0.27682	0.27682	0.27682
125.00	25.00*	414.03	82.81*	0.12090	0.19114	0.23951	0.26260	0.27171	0.27503	0.27620	0.27661
150.00	50.00*	496.84	165.61*	0.04325	0.09621	0.16752	0.22565	0.25660	0.26944	0.27421	0.27591
150.00	0.00*	496.84	0.00*	0.20094	0.20094	0.20094	0.20094	0.20094	0.20094	0.20094	0.20094
175.00	25.00*	579.64	82.81*	0.08068	0.11875	0.15206	0.17485	0.18792	0.19468	0.19793	0.19956
200.00	50.00*	662.45	165.61*	0.02774	0.05154	0.08565	0.12365	0.15574	0.17708	0.18811	0.19527
200.00	0.00*	662.45	0.00*	0.12564	0.12564	0.12564	0.12564	0.12564	0.12564	0.12564	0.12564
225.00	25.00*	745.25	82.81*	0.04617	0.06083	0.07571	0.08922	0.10030	0.10865	0.11455	0.11854
250.00	50.00*	828.06	165.61*	0.01521	0.02301	0.03340	0.04637	0.06105	0.07592	0.08940	0.10044
250.00	0.00*	828.06	0.00*	0.05561	0.05561	0.05561	0.05561	0.05561	0.05561	0.05561	0.05561
275.00	25.00*	910.87	82.81*	0.01874	0.02146	0.02432	0.02725	0.03020	0.03309	0.03587	0.03843
300.00	50.00*	993.67	165.61*	0.00602	0.00726	0.00870	0.01038	0.01229	0.01444	0.01683	0.01942
300.00	0.00*	993.67	0.00*	0.01192	0.01192	0.01192	0.01192	0.01192	0.01192	0.01192	0.01192
325.00	25.00*	1076.48	82.81*	0.00380	0.00392	0.00404	0.00416	0.00429	0.00441	0.00454	0.00467
350.00	50.00*	1159.28	165.61*	0.00120	0.00125	0.00130	0.00135	0.00141	0.00147	0.00153	0.00159
350.00	0.00*	1159.28	0.00*	0.00139	0.00139	0.00139	0.00139	0.00139	0.00139	0.00139	0.00139
375.00	25.00*	1242.09	82.81*	0.00044	0.00044	0.00044	0.00044	0.00044	0.00044	0.00045	0.00045
400.00	50.00*	1324.90	165.61*	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014
400.00	0.00*	1324.90	0.00*	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014
425.00	25.00*	1407.70	82.81*	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004
450.00	50.00*	1490.51	165.61*	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
450.00	0.00*	1490.51	0.00*	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
475.00	25.00*	1573.31	82.81*	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

ภาคผนวก ก-2

ภาคผนวกนี้แสดงโปรแกรมคอมพิวเตอร์และลักษณะการกระจายความชื้นในชั้นมันสำปะหลังหนา 40 ซม ของทั้งการคำนวณและการทดลองสำหรับกรณีการอบแห้งโดยสลับทิศทางลมร้อนเป็นครั้งคราว (ในที่นี้จะแสดงตัวอย่างของกรณีที่สลับทิศทางลมร้อนทุก ๆ 30 นาที)

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      $JOB            DBAL4444 KAMONRAT PHANARAYA
    1     DIMENSION ETA(100),A(100),HJ(100),ATA(100),AEXP(20,10),BTA(100),FT
          *A(100)
      C   AEXP(I,J)=VALUE OF MOISTURE CONTENT OF THE DRYING MATERIAL IN THE BED AT
      C   DIFFERENT HEIGHT
      C   CB=FINAL MOISTURE CONTENT(KG WATER/ KG DRY SOLID)
      C   EC=EQUILIBRIUM MOISTURE CONTENT(KG WATER/KG DRY SOLID)
      C   DEN=DENSITY (KG/CUBIC M)
      C   AFSION=FRACTION OF VOL OCCUPIED BY DRY MATERIAL IN PACKED BED
      C         =1-(VOID FRACTION)
      C   CC=CRITICAL MOISTURE CONTENT(KG WATER/KG DRY SOLID)
      C   CCMASS=MASS TRANSFER COEFFICIENT(KG/CUBIC M.HR.DELTA H)
      C   NPOINT=NUMBER OF COLUMN OF DATA (MOISTURE CONTENT) FROM THE LONG BED EXP
      C   ( REVERSE FLOW ) PLUS COLUMN OF TIME AND AVERAGE MOISTURE CONTENT
      C   NATA=NUMBER OF ROW OF DATA(TIME) FROM THE LONG BED EXP( REVERSE FLOW)
      C   ATA(J)=DISTANCE(CM)(FROM THE EXP)
      C   BTA(J)=DISTANCE(CM)(USED IN THE CALCULATION)
      C   FLOW=MASS FLOW RATE (KG DRY AIR/HR. SQUARE M)
      C   LPOINT=NUMBER OF COLUMN OF DATA (MOISTURE CONTENT) FROM THE LONG BED EXP
      C   ( REVERSE FLOW ) PLUS COLUMN OF TIME
      C   JPOINT=NUMBER OF DATA OF DISTANCE AT DIFFERENT HEIGHT OF BED
      C   N=NUMBER OF MOISTURE CONTENT CALCULATED FROM THE NUMERICAL INTEGRATION
      C   SN=NUMBER OF DEVICED INTERVAL IN THE NUMERICAL INTEGRATION
      C   TS=TIME INTERVAL BEFORE EACH REVERSE DIRECTION OF AIR FLOW
      C   TV=TIME INTERVAL ADDED TO INCREASE TIME INTERVAL BEFORE EACH REVERSE
      C   DIRECTION OF AIR FLOW
      C   TF=TIME INTERVAL OF EACH CALCULATION OF PROFILE OF MOISTURE CONTENT
      C   PI=VALUE OF MOISTURE CONTENT OF AIR AT WET BULB TEMPERATURE MINUS VALUE OF
      C   MOISTURE CONTENT OF AIR BEFORE ENTER THE BED
      C      READ ALL DATA USED IN THE CALCULATION
    2        READ(5,66) CB,EC,DEN,ETAL,AFSION,CC
    3     66 FORMAT(8F10.5)
    4        READ(5,222) CCMASS,NPOINT,NATA
    5    222 FORMAT(F15.5,2I10)
    6        READ(5,181) FLOW,LPOINT,JPOINT
    7    181 FORMAT(F8.4,2I10)
    8        READ(5,16)(ATA(J),J=3,NPOINT)
    9     16 FORMAT(10F5.3)
   10        READ(5,17)(BTA(J),J=1,JPOINT)
   11     17 FORMAT(16F5.3)
   12        READ(5,150)((AEXP(I,J),J=1,LPOINT),I=1,NATA)
   13    150 FORMAT(9F8.4)
   14        WRITE(6,101)
   15    101 FORMAT(1H1)
   16        WRITE(6,67) CB,EC,DEN,ETAL,AFSION,CC
   17     67 FORMAT(/2X,'CB=',F10.5,2X,'EC=',F10.5,2X,'DEN=',F10.2,2X,'ETAL=',F
          *10.5//2X,'AFSION=',F10.5,2X,'CC=',F10.5)
   18        WRITE(6,223) CCMASS,NPOINT,NATA
   19    223 FORMAT(/2X,'CCMASS=',F12.2,2X,'NPOINT=',I10,2X,'NATA=',I10)
   20        WRITE(6,182) FLOW,LPOINT,JPOINT
   21    182 FORMAT(/2X,'MASS FLOW RATE=',F10.2,2X,'LPOINT=',I10,2X,'JPOINT=',I
          *10)
   22        READ(5,40) N,SN,TS,TV,PI,TF
   23     40 FORMAT(I10,5F10.5)
   24        WRITE(6,73) N,SN,TS,TV,PI,TF
   25     73 FORMAT(/2X,'N=',I10,2X,'SN=',F10.5,2X,'TS=',F10.2,2X,'TV=',F10.3//
          *2X,'PI=',F10.5,2X,'TF=',F10.5)
      C   WRITE(6,5)SHOW DATA FROM THE EXPERIMENT IN CASE OF REVERSE FLOW
   26     5 WRITE(6,101)
   27        WRITE(6,15)(ATA(J),J=3,NPOINT)
```

```
      151 FORMAT(50X,'TABLE OF RAW DATA BETWEEN TIME&MOISTURE IN CASE OF REV
     *ERSE FLOW'///2X,'TIME(MIN)   *     *       *',3(X,'VALUE OF MOISTURE
     *AT DISTANCE(CM)=',2GX,'MEAN'//25X,'*',2X,8F10.5///)
      DO 152 I=1,NATA
      AEXP(I,NPOINT)=(AEXP(I,2)+AEXP(I,3)+AEXP(I,4)+AEXP(I,5)+AEXP(I,6)+
     *AEXP(I,7)+AEXP(I,8)+AEXP(I,9))/8.
      152 CONTINUE
      WRITE(6,153)((AEXP(I,J),J=1,NPOINT),I=1,NATA)
      153 FORMAT(2X,F7.2,19X,9F10.5)
C     WRITE$SHOW DATA IN DIMENSIONLESS FORM IN CASE OF REVERSE FLOW
      DO 154 I=1,NATA
      DO 154 J=2,NPOINT
      AEXP(I,J)=(AEXP(I,J))/CC
      154 CONTINUE
      ACA=(AEXP(1,2)+AEXP(1,3)+AEXP(1,4)+AEXP(1,5)+AEXP(1,6)+AEXP(1,7)+A
     *EXP(1,8)+AEXP(1,9))/8.
      DO 155 J=3,NPOINT
      ETA(J)=ATA(J)*CCMASS/100./FLOW
      155 CONTINUE
      WRITE(6,101)
      DO 157 I=1,NATA
      AEXP(I,NPOINT)=(AEXP(I,2)+AEXP(I,3)+AEXP(I,4)+AEXP(I,5)+AEXP(I,6)+
     *AEXP(I,7)+AEXP(I,8)+AEXP(I,9))/8.
      157 CONTINUE
      WRITE(6,158)(ETA(J),J=3,NPOINT)
      158 FORMAT(/50X,'TABLE OF DATA IN DIMENSIONLESS IN CASE OF REVERSE FLO
     *W'///2X,'TIME(MIN)   TAU       ',25X,'VALUE OF FI AT ETA=',32X,'FI
     *... MEAN'//25X,'*',8F10.5///)
      WRITE(6,159)((AEXP(I,J),J=1,NPOINT),I=1,NATA)
      159 FORMAT(2X,F7.2,17X,9F10.5)
      CA=(ACA*CC)
C     PROGRAM TO CALCULATE PROFILE OF MOISTURE IN THROUCH FLOW DRYER
      FIONA=(CA-EC)/(CC-EC)
      FIOFF=(CB-EC)/(CC-EC)
      WRITE(6,131) FIONA,FIOFF
      131 FORMAT(//2X,'FIONA=',F10.5,2X,'FIOFF=',F10.5)
C     WRITE TYPING OF CALATION FOR PROFILE
      DO 401 J=1,JPOINT
      ETA(J)=BTA(J)*CCMASS/100./FLOW
      401 CONTINUE
      WRITE(6,120)(ETA(J),J=1,8)
      120 FORMAT(/50X,'TABLE OF CALCULATION FOR PROFILE'///2X,'TIME(MIN)  *
     *       TAU    *',20X,'VALUE OF FI AT ETA ='//25X,'*',2X,10F10.5///)
      WRITE(6,627)(ETA(J),J=9,JPOINT)
      627 FORMAT(25X,'*',2X,10F10.5///)
      TUS=COMASS*TS/(AFSION*DEN*(CC-EC)*60.)
      TUV=COMASS*TV/(AFSION*DEN*(CC-EC)*60.)
      TUE=COMASS*TF/(AFSION*DEN*(CC-EC)*60.)
      H=ETAL/SN
      31 WRITE(6,185)
      185 FORMAT(2X,'DIRECTION OF FLOW IS FORWARD')
      TTF=0.
   20 TUT=0.
      TG=0.
   42 W=EXP(PI*TUT)
      I=1
      SS=0.0
   45 S=(SS*H)
      A(I)=FIONA*(EXP(FIONA*S))/(W+EXP(FIONA*S)-1)
      SS=SS+1.
```

```
      I=I+1
      IF(I.GT.N) GO TO 46
      GO TO 45
   46 WRITE(6,90) TG,TUT,A(1),A(3),A(5),A(7),A(9),A(11),A(13),A(15)
   90 FORMAT(2X,F10.4,4X,F10.4,2X,10F10.5)
      WRITE(6,91) TG,TUT,A(17),A(19),A(21),A(23),A(25),A(27),A(29),A(31)
     *,A(33)
   91 FORMAT(2X,F10.4,4X,F10.4,2X,10F10.5)
      TUT=TUT+TUF
      TG=TG+TF
      IF(TUT.GT.TUS) GO TO 308
      GO TO 42
  308 TTG=TG+TTF-TF
      WRITE(6,711) TTG
  711 FORMAT(55X,'ACCUMULATE TIME (MIN) ',F10.2)
  311 WRITE(6,11)
   11 FORMAT(//2X,'DIRECTION OF FLOW IS BACKWARD')
      TUT=0.
      TG=0.
      WRITE(6,15) TG,TUT,A(1),A(3),A(5),A(7),A(9),A(11),A(13),A(15)
   15 FORMAT(2X,F10.4,4X,F10.4,2X,10F10.5)
      WRITE(6,37) TG,TUT,A(17),A(19),A(21),A(23),A(25),A(27),A(29),A(31)
     *,A(33)
   37 FORMAT(2X,F10.4,4X,F10.4,2X,10F10.5)
      GO TO 113
  550 TTG=TG+TTF-TF
      WRITE(6,801) TTG
  801 FORMAT(55X,'ACCUMULATE TIME (MIN) = ',F10.2)
   50 WRITE(6,100)
  100 FORMAT(//2X,'DIRECTION OF FLOW IS BACKWARD')
      TUT=0.
      TG=0.
      WRITE(6,500) TG,TUT,A(1),A(3),A(5),A(7),A(9),A(11),A(13),A(15)
  500 FORMAT(2X,F10.4,4X,F10.4,2X,10F10.5)
      WRITE(6,503) TG,TUT,A(17),A(19),A(21),A(23),A(25),A(27),A(29),A(31
     *),A(33)
  503 FORMAT(2X,F10.4,4X,F10.4,2X,10F10.5)
  113 TUT=TUF
      TG=TF
   70 W=EXP(PI*TUT)
      I=N
      FL=A(N)
      CB=FL/W
      HJ(N)=CB
      I=N-1
      D=0.
      E=1.
      D=0.
      Y=A(N)
   75 AJ=(A(I)+Y)*(H/2.)
      Y=A(I)
      D=D+AJ
      U=EXP(D)
      V=(U+E)*(H/2.)
      E=U
      D=D+V
      HJ(I)=U/((W/FL)+D)
      IF(I.EQ.1) GO TO 85
      I=I-1
      GO TO 75
```

```
      85 WRITE(6,104) TG,TUT,HJ(1),HJ(3),HJ(5),HJ(7),HJ(9),HJ(11),HJ(13),HJ
     *(15)
     104 FORMAT(2X,F10.4,4X,F10.4,2X,10F10.5)
         WRITE(6,112) TG,TUT,HJ(17),HJ(19),HJ(21),HJ(23),HJ(25),HJ(27),HJ(2
     *9),HJ(31),HJ(33)
     112 FORMAT(2X,F10.4,4X,F10.4,2X,10F10.5)
         TUT=TUT+TUF
         TG=TG+TF
         IF(TUT.GT.TUS) GO TO 92
         GO TO 70
      92 Z=0/ETAL
         IF(Z.LT.FICEF) GE TO 95
         GO TO 751
      95 WRITE(6,89)
      89 FORMAT(50X,REFINISHED//)
         TUS=TUS+TUV
         IF(TUS.GT.496.83) GO TO 107
         GO TO 31
     751 TTF=TG+TTG-TF
         WRITE(6,721) TTF
     721 FORMAT(55X,'ACCUMULATE TIME (MIN) ',F10.2)
     102 WRITE(6,185)
         TUT=0.
         TG=0.
         WRITE(6,600) TG,TUT,HJ(1),HJ(3),HJ(5),HJ(7),HJ(9),HJ(11),HJ(13),HJ
     *(15)
     600 FORMAT(2X,F10.4,4X,F10.4,2X,10F10.5)
         WRITE(6,611) TG,TUT,HJ(17),HJ(19),HJ(21),HJ(23),HJ(25),HJ(27),HJ(2
     *9),HJ(31),HJ(33)
     611 FORMAT(2X,F10.4,4X,F10.4,2X,10F10.5)
         TUT=TUF
         TG=TF
     111 W=EXP(PI*TUT)
         I=1
         FL=HJ(1)
         CB=FL/W
         A(1)=CB
         I=2
         D=0.
         E=1.
         D=0.
         Y=HJ(1)
     121 AJ=(HJ(I)+Y)*(H/2.)
         Y=HJ(I)
         D=D+AJ
         U=EXP(D)
         V=(U+E)*(H/2.)
         E=U
         D=D+V
         A(I)=U/((W/FL)+D)
         IF(I.EQ.N) GO TO 190
         I=I+1
         GO TO 121
     190 WRITE(6,138) TG,TUT,A(1),A(3),A(5),A(7),A(9),A(11),A(13),A(15)
     138 FORMAT(2X,F10.4,4X,F10.4,2X,10F10.5)
         WRITE(6,647) TG,TUT,A(17),A(19),A(21),A(23),A(25),A(27),A(29),A(3
     *),A(33)
     647 FORMAT(2X,F10.4,4X,F10.4,2X,10F10.5)
         TUT=TUT+TUF
         TG=TG+TF
```

```
      189          IF(TUT.GT.TUS) GO TO 140
      190          GO TO 111
      191      140 Z=0/FTAL
      192          IF(Z.LT.FTOFF) GO TO 95
      193          GO TO 550
      194      107 STOP
      195          END
```

SENTRY

```
CB=    0.00610  EC=    0.00000  DEN=     924.13  ETAL=   30.53000
AESION=    0.23000  CC=    3.85000
COMASS=    162626.00  NPOINT=         10  NATA=         20
MASS FLOW RATE=    2130.00  LPOINT=          9  JPOINT=         17
N=         33  SN=   32.00000  TS=      30.00  TV=      30.00
PI=    0.01400  TF=   10.00000
```

TABLE OF RAW DATA BETWEEN TIME&MOISTURE IN CASE OF REVERSE FLOW

TIME(MIN) * * *	VALUE OF MOISTUREAT DISTANCE(CM)= 2.50000	7.50000	12.50000	17.50000	22.50000	27.50000	32.50000	37.50000	MEAN
0.00	1.84100	1.81800	1.82500	1.82500	1.82100	1.82100	1.81800	1.82100	1.82375
30.00	0.75000	1.54200	1.75400	1.79900	1.81200	1.81700	1.81000	1.79500	1.63512
60.00	0.72400	1.48500	1.72200	1.77100	1.77500	1.74100	1.55900	0.77700	1.44175
90.00	0.15700	0.76400	1.43900	1.68400	1.73500	1.71200	1.51000	0.74500	1.21825
120.00	0.02300	0.71000	1.39700	1.64800	1.66400	1.51300	0.90400	0.19100	1.00625
150.00	0.02800	0.19900	0.81400	1.42400	1.57900	1.47300	0.53400	0.23400	0.78562
180.00	0.09900	0.22100	0.75900	1.37200	1.46700	1.10300	0.32600	0.03900	0.67325
210.00	0.01600	0.02900	0.23800	0.84800	1.27600	1.02900	0.32600	0.11900	0.48637
240.00	0.07700	0.10500	0.23800	0.72700	0.89800	0.43200	0.06500	0.01800	0.32000
270.00	0.01500	0.02500	0.24700	0.32600	0.63700	0.37500	0.10800	0.06600	0.22487
300.00	0.03700	0.03700	0.05900	0.16100	0.24400	0.09400	0.01500	0.01200	0.08237
330.00	0.00500	0.02900	0.05200	0.02900	0.06300	0.03400	0.01500	0.01200	0.03250
360.00	0.00500	0.00500	0.00500	0.00900	0.00000	0.00000	0.00000	0.00000	0.00300
390.00	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
420.00	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
450.00	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
480.00	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
510.00	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
540.00	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
570.00	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

TABLE OF DATA IN DIMENSIONLESS IN CASE OF REVERSE FLOW

TIME(MIN)	TAU	VALUE OF FI AT ETA=								FI MEAN
	*	1.90876	5.72627	9.54378	13.36129	17.17879	20.99631	24.81381	28.63133	
0.00		0.47818	0.47221	0.47403	0.47403	0.47299	0.47299	0.47221	0.47299	0.47370
30.00		0.19481	0.40052	0.45610	0.46727	0.47065	0.47195	0.47013	0.46523	0.42471
60.00		0.18805	0.38571	0.44727	0.46000	0.46104	0.45221	0.39574	0.20182	0.37448
90.00		0.04078	0.19844	0.37377	0.43740	0.45065	0.44468	0.39221	0.13351	0.31643
120.00		0.00597	0.18442	0.36296	0.42805	0.43221	0.39299	0.23481	0.04951	0.26136
150.00		0.00727	0.05169	0.21143	0.36987	0.41013	0.38260	0.13870	0.06078	0.20406
180.00		0.02571	0.05740	0.19714	0.35636	0.38104	0.28649	0.08468	0.01013	0.17487
210.00		0.00416	0.01013	0.06182	0.22026	0.33143	0.26727	0.08468	0.03091	0.12633
240.00		0.02000	0.02727	0.06182	0.18883	0.23325	0.11221	0.01688	0.00468	0.09312
270.00		0.00390	0.00649	0.06416	0.08468	0.16545	0.09740	0.02805	0.01714	0.05841
300.00		0.00961	0.00961	0.01532	0.04182	0.06338	0.02442	0.00390	0.00312	0.02140
330.00		0.00130	0.01013	0.01377	0.01013	0.01636	0.00883	0.00390	0.00312	0.00844
360.00		0.00130	0.00130	0.00130	0.00234	0.00000	0.00000	0.00000	0.00000	0.00078
390.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
420.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
450.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
480.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
510.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
540.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
570.00		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

FIONA= 0.47370 FIOFF= 0.00003

TABLE OF CALCULATION FOR PROFILE

TIME(MIN)	*	TAU	*	VALUE OF FI AT ETA =								
			*	0.00000	1.90876	3.81751	5.72627	7.63502	9.54378	11.45253	13.36129	
			*	15.27005	17.17879	19.08755	20.99631	22.90506	24.81381	26.72258	28.63133	30.54008
DIRECTION OF FLOW IS FORWARD												
0.0000		0.0000		0.47370	0.47370	0.47370	0.47370	0.47370	0.47370	0.47370	0.47370	
0.0000		0.0000		0.47370	0.47370	0.47370	0.47370	0.47370	0.47370	0.47370	0.47370	0.47370
10.0000		33.1220		0.29793	0.38235	0.43191	0.45584	0.46630	0.47067	0.47247	0.47330	
10.0000		33.1220		0.47350	0.47362	0.47367	0.47369	0.47370	0.47370	0.47370	0.47370	0.47370
20.0000		66.2441		0.19738	0.29262	0.37877	0.43005	0.45500	0.46594	0.47053	0.47241	
20.0000		66.2441		0.47318	0.47349	0.47361	0.47367	0.47369	0.47369	0.47370	0.47370	0.47370
30.0000		99.3661		0.11795	0.21311	0.31681	0.39456	0.43811	0.45861	0.46747	0.47116	
30.0000		99.3661		0.47267	0.47328	0.47353	0.47363	0.47367	0.47369	0.47370	0.47370	0.47370
ACCUMULATE TIME (MIN) = 30.00												
DIRECTION OF FLOW IS BACKWARD												
0.0000		0.0000		0.11785	0.21311	0.31681	0.39456	0.43811	0.45861	0.46747	0.47116	
0.0000		0.0000		0.47267	0.47328	0.47353	0.47363	0.47367	0.47369	0.47370	0.47370	0.47370
10.0000		33.1220		0.25528	0.32420	0.38583	0.42695	0.44864	0.45857	0.46280	0.46451	
10.0000		33.1220		0.46512	0.46513	0.46456	0.46292	0.45883	0.44899	0.42639	0.37926	0.29793
20.0000		66.2441		0.25528	0.32420	0.38583	0.42695	0.44863	0.45855	0.46275	0.46439	

20.0000	66.2441	0.46481	0.46437	0.46268	0.45835	0.44788	0.42395	0.37452	0.29031	0.18738
30.0000	99.3661	0.25528	0.32420	0.38583	0.42694	0.44862	0.45852	0.46267	0.46419	
30.0000	99.3661	0.46431	0.46316	0.45973	0.45125	0.43151	0.38942	0.31383	0.21214	0.11785

ACCUMULATE TIME (MIN) = 60.00

DIRECTION OF FLOW IS FORWARD

0.0000	0.0000	0.25528	0.32420	0.38583	0.42694	0.44862	0.45852	0.46267	0.46419	
0.0000	0.0000	0.46431	0.46316	0.45973	0.45125	0.43151	0.38942	0.31383	0.21214	0.11785
10.0000	33.1220	0.16056	0.19811	0.25335	0.31754	0.37434	0.41358	0.43617	0.44771	
10.0000	33.1220	0.45206	0.45498	0.45449	0.45097	0.44169	0.42097	0.38135	0.32147	0.25389
20.0000	66.2441	0.10098	0.13962	0.19924	0.27461	0.34668	0.39880	0.42921	0.44455	
20.0000	66.2441	0.45176	0.45444	0.45427	0.45087	0.44165	0.42095	0.38135	0.32147	0.25389
30.0000	99.3661	0.06351	0.09502	0.14874	0.22603	0.31024	0.37736	0.41858	0.43993	
30.0000	99.3661	0.44971	0.45359	0.45391	0.45073	0.44159	0.42093	0.38134	0.32146	0.25389

ACCUMULATE TIME (MIN) = 90.00

DIRECTION OF FLOW IS BACKWARD

0.0000	0.0000	0.06351	0.09502	0.14874	0.22603	0.31024	0.37736	0.41858	0.43993	
0.0000	0.0000	0.44971	0.45359	0.45391	0.45073	0.44159	0.42093	0.38134	0.32146	0.25389
10.0000	33.1220	0.17028	0.21050	0.26211	0.32007	0.37252	0.40954	0.43043	0.43993	
10.0000	33.1220	0.44234	0.43897	0.42841	0.40660	0.36847	0.31328	0.25073	0.19670	0.15968
20.0000	66.2441	0.17027	0.21050	0.26211	0.32005	0.37248	0.40943	0.43019	0.43993	
20.0000	66.2441	0.44097	0.43576	0.42122	0.39155	0.34066	0.27046	0.19697	0.13934	0.10043
30.0000	99.3661	0.17027	0.21049	0.26209	0.32001	0.37241	0.40927	0.42979	0.43847	
30.0000	99.3661	0.43879	0.43076	0.41027	0.36980	0.30416	0.22217	0.14686	0.09424	0.06317

ACCUMULATE TIME (MIN) = 120.00

DIRECTION OF FLOW IS FORWARD

0.0000	0.0000	0.17027	0.21049	0.26209	0.32001	0.37241	0.40927	0.42979	0.43847	
0.0000	0.0000	0.43879	0.43076	0.41027	0.36980	0.30416	0.22217	0.14686	0.09424	0.06317
10.0000	33.1220	0.10709	0.12345	0.14923	0.18834	0.24164	0.30188	0.35566	0.39363	
10.0000	33.1220	0.41498	0.42266	0.41836	0.40025	0.36518	0.31463	0.25849	0.20823	0.16885
20.0000	66.2441	0.06735	0.08378	0.10932	0.14894	0.20564	0.27356	0.33722	0.38349	
20.0000	66.2441	0.40999	0.42041	0.41737	0.39982	0.36495	0.31455	0.25845	0.20821	0.16884
30.0000	99.3661	0.04236	0.05544	0.07670	0.11177	0.16626	0.23806	0.31154	0.36841	
30.0000	99.3661	0.40238	0.41689	0.41581	0.39914	0.36470	0.31442	0.25839	0.20818	0.16882

ACCUMULATE TIME (MIN) = 150.00

DIRECTION OF FLOW IS BACKWARD

0.0000	0.0000	0.04236	0.05544	0.07670	0.11177	0.16626	0.23806	0.31154	0.36841	
0.0000	0.0000	0.40238	0.41689	0.41581	0.39914	0.36470	0.31442	0.25839	0.20818	0.16882
10.0000	33.1220	0.12567	0.14866	0.17912	0.21879	0.26706	0.31791	0.36060	0.39639	
10.0000	33.1220	0.39251	0.37879	0.34504	0.29421	0.23653	0.18521	0.14735	0.12222	0.10618
20.0000	66.2441	0.12564	0.14862	0.17905	0.21867	0.26681	0.31740	0.35949	0.38336	
20.0000	66.2441	0.38730	0.36822	0.32631	0.28584	0.20074	0.14616	0.10779	0.08239	0.06678
30.0000	99.3661	0.12559	0.14855	0.17894	0.21846	0.26642	0.31659	0.35774	0.38016	
30.0000	99.3661	0.37930	0.35282	0.30038	0.23050	0.16183	0.10947	0.07554	0.05433	0.04200

ACCUMULATE TIME (MIN) = 180.00

DIRECTION OF FLOW IS FORWARD

0.0000	0.0000	0.12559	0.14855	0.17894	0.21846	0.26642	0.31659	0.35774	0.38016	
0.0000	0.0000	0.37930	0.35282	0.30038	0.23050	0.16183	0.10947	0.07554	0.05433	0.04200
10.0000	33.1220	0.07899	0.08748	0.09991	0.11842	0.14604	0.18557	0.23593	0.28330	
10.0000	33.1220	0.32818	0.24481	0.23454	0.20155	0.25680	0.21236	0.17502	0.14594	0.12379
20.0000	66.2441	0.04968	0.05819	0.07031	0.08824	0.11538	0.15548	0.20896	0.25740	
20.0000	66.2441	0.31471	0.23720	0.23071	0.20967	0.25586	0.21186	0.17473	0.14577	0.12368
30.0000	99.3661	0.03125	0.03797	0.04779	0.06280	0.08650	0.12261	0.17682	0.23017	
30.0000	99.3661	0.29544	0.22509	0.22481	0.20473	0.25427	0.21107	0.17423	0.14543	0.12349

ACCUMULATE TIME (MIN) = 210.00

DIRECTION OF FLOW IS BACKWARD

0.0000	0.0000	0.03125	0.03797	0.04779	0.06280	0.08650	0.12361	0.17692	0.23937	
0.0000	0.0000	0.29544	0.32599	0.32481	0.29673	0.25437	0.21107	0.17423	0.14549	0.12349
10.0000	33.1220	0.09700	0.11067	0.12802	0.15019	0.17821	0.21177	0.24675	0.27315	
10.0000	33.1220	0.27848	0.25759	0.21840	0.17583	0.14053	0.11508	0.09769	0.08534	0.07767
20.0000	66.2441	0.09671	0.11026	0.12742	0.14930	0.17676	0.20928	0.24230	0.26512	
20.0000	66.2441	0.26482	0.23705	0.19205	0.14648	0.11055	0.08550	0.06961	0.05705	0.04885
30.0000	99.3661	0.09625	0.10963	0.12651	0.14790	0.17451	0.20545	0.23553	0.25327	
30.0000	99.3661	0.24566	0.21038	0.16114	0.11576	0.08256	0.06069	0.04657	0.03720	0.03072

ACCUMULATE TIME (MIN) 240.00

DIRECTION OF FLOW IS FORWARD

0.0000	0.0000	0.09625	0.10963	0.12651	0.14790	0.17451	0.20545	0.23553	0.25327	
0.0000	0.0000	0.24566	0.21038	0.16114	0.11576	0.08256	0.06069	0.04657	0.03720	0.03072
10.0000	33.1220	0.06054	0.06532	0.07176	0.08059	0.09285	0.10993	0.13287	0.16033	
10.0000	33.1220	0.18568	0.19866	0.19419	0.17704	0.15553	0.13505	0.11755	0.10316	0.09143
20.0000	66.2441	0.03807	0.04288	0.04918	0.05768	0.06947	0.08606	0.10991	0.13749	
20.0000	66.2441	0.16592	0.18356	0.18383	0.17031	0.15118	0.13217	0.11557	0.10175	0.09039
30.0000	99.3661	0.02395	0.02773	0.03278	0.03973	0.04961	0.06297	0.08464	0.11210	
30.0000	99.3661	0.14191	0.16377	0.16945	0.16061	0.14474	0.12783	0.11255	0.09959	0.08878

ACCUMULATE TIME (MIN) = 270.00

DIRECTION OF FLOW IS BACKWARD

0.0000	0.0000	0.02395	0.02773	0.03278	0.03973	0.04961	0.06297	0.08464	0.11210	
0.0000	0.0000	0.14191	0.16377	0.16945	0.16061	0.14474	0.12783	0.11255	0.09959	0.08878
10.0000	33.1220	0.06888	0.07522	0.08253	0.09088	0.10017	0.10989	0.11874	0.12427	
10.0000	33.1220	0.12366	0.11607	0.10407	0.09144	0.08048	0.07175	0.06501	0.05983	0.05584
20.0000	66.2441	0.06654	0.07231	0.07884	0.08612	0.09394	0.10165	0.10785	0.11024	
20.0000	66.2441	0.10648	0.09648	0.08321	0.07022	0.05935	0.05083	0.04426	0.03915	0.03512
30.0000	99.3661	0.06313	0.06811	0.07360	0.07950	0.08549	0.09083	0.09415	0.09347	
30.0000	99.3661	0.08722	0.07607	0.06310	0.05129	0.04187	0.03473	0.02935	0.02526	0.02209

ACCUMULATE TIME (MIN) 300.00

DIRECTION OF FLOW IS FORWARD

0.0000	0.0000	0.06213	0.06811	0.07360	0.07950	0.08549	0.09083	0.09415	0.09347	
0.0000	0.0000	0.08722	0.07607	0.06310	0.05129	0.04187	0.03473	0.02935	0.02526	0.02209
10.0000	33.1220	0.03970	0.04164	0.04393	0.04663	0.04978	0.05339	0.05732	0.06126	
10.0000	33.1220	0.06458	0.06660	0.06694	0.06575	0.06350	0.06067	0.05760	0.05462	0.05155
20.0000	66.2441	0.02497	0.02693	0.02922	0.03190	0.03503	0.03864	0.04268	0.04699	
20.0000	66.2441	0.05078	0.05372	0.05528	0.05545	0.05454	0.05294	0.05095	0.04880	0.04661
30.0000	99.3661	0.01571	0.01725	0.01907	0.02124	0.02382	0.02685	0.03035	0.03415	
30.0000	99.3661	0.03790	0.04109	0.04329	0.04439	0.04455	0.04403	0.04306	0.04183	0.04046

ACCUMULATE TIME (MIN) = 330.00

DIRECTION OF FLOW IS BACKWARD

0.0000	0.0000	0.01571	0.01725	0.01907	0.02124	0.02382	0.02685	0.03035	0.03415	
0.0000	0.0000	0.03790	0.04109	0.04329	0.04439	0.04455	0.04403	0.04306	0.04183	0.04046
10.0000	33.1220	0.02879	0.02949	0.03016	0.03076	0.03126	0.03163	0.03182	0.03180	
10.0000	33.1220	0.03152	0.03104	0.03036	0.02957	0.02871	0.02785	0.02700	0.02620	0.02544
20.0000	66.2441	0.02326	0.02357	0.02382	0.02399	0.02406	0.02401	0.02379	0.02340	
20.0000	66.2441	0.02284	0.02210	0.02125	0.02034	0.01940	0.01848	0.01761	0.01678	0.01600
30.0000	99.3661	0.01782	0.01787	0.01786	0.01778	0.01762	0.01735	0.01693	0.01649	
30.0000	99.3661	0.01587	0.01516	0.01439	0.01359	0.01280	0.01205	0.01133	0.01067	0.01007

ACCUMULATE TIME (MIN) 360.00

DIRECTION OF FLOW IS FORWARD

0.0000	0.0000	0.01782	0.01787	0.01786	0.01778	0.01762	0.01735	0.01693	0.01649	
0.0000	0.0000	0.01587	0.01516	0.01439	0.01359	0.01280	0.01205	0.01133	0.01067	0.01007
10.0000	33.1220	0.01121	0.01185	0.01149	0.01168	0.01176	0.01189	0.01201	0.01212	
10.0000	33.1220	0.01221	0.01229	0.01234	0.01238	0.01240	0.01240	0.01237	0.01235	0.01231
20.0000	66.2441	0.00705	0.00719	0.00734	0.00749	0.00763	0.00778	0.00792	0.00805	

20.0000	66.2441	C.00818	C.00829	C.00839	C.00848	C.00856	C.00862	0.00867	0.00871	0.00874
30.0000	99.3661	0.00443	C.00455	0.00466	0.00478	C.00490	C.00502	0.00514	0.00525	
30.0000	99.3661	0.00536	C.00547	C.00556	0.00565	0.00573	C.00581	0.00587	0.00593	0.00598

ACCUMULATE TIME (MIN) = 390.00

DIRECTION OF FLOW IS BACKWARD

0.0000	0.0000	C.00443	0.00455	0.00466	0.00478	C.00490	C.00502	0.00514	0.00525	
0.0000	0.0000	C.00536	C.00547	C.00556	0.00565	0.00573	C.00581	0.00587	0.00593	0.00598
10.0000	33.1220	0.00393	C.00392	0.00392	0.00392	0.00391	C.00390	0.00389	0.00389	
10.0000	33.1220	0.00387	C.00386	0.00385	0.00383	0.00382	C.00381	0.00379	0.00378	0.00376
20.0000	66.2441	C.00258	0.00257	0.00256	0.00255	0.00254	0.00253	0.00251	0.00250	
20.0000	66.2441	0.00249	C.00247	0.00246	0.00244	0.00243	C.00241	0.00240	0.00238	0.00237
30.0000	99.3661	C.00167	C.00166	C.00165	0.00164	0.00163	C.00162	0.00161	0.00160	
30.0000	99.3661	0.00159	C.00157	C.00156	C.00155	0.00154	0.00153	0.00151	0.00150	0.00149

ACCUMULATE TIME (MIN) = 420.00

DIRECTION OF FLOW IS FORWARD

0.0000	0.0000	C.00167	C.00166	0.00165	C.00164	0.00162	0.00162	0.00161	0.00160	
0.0000	0.0000	0.00159	C.00157	C.00156	C.00155	0.00154	C.00153	0.00151	0.00150	0.00149
10.0000	33.1220	0.00105	0.00105	C.00105	C.00105	0.00105	C.00105	0.00106	0.00106	
10.0000	33.1220	0.00106	C.00106	0.00106	C.00106	0.00106	C.00106	0.00106	0.00106	0.00107
20.0000	66.2441	0.00066	C.00066	C.00066	0.00066	C.00066	C.00067	0.00067	0.00067	
20.0000	66.2441	0.00067	C.00067	C.00067	C.00067	C.00067	C.00067	0.00068	0.00068	0.00068
30.0000	99.3661	C.00041	0.00042	C.00042	C.00042	C.00042	C.00042	0.00042	0.00042	
30.0000	99.3661	0.00042	C.00042	0.00042	0.00043	0.00043	C.00043	0.00043	0.00043	0.00043

ACCUMULATE TIME (MIN) = 450.00

DIRECTION OF FLOW IS BACKWARD

0.0000	0.0000	C.00041	0.00042	0.00042	C.00042	0.00042	C.00042	0.00042	0.00042	
0.0000	0.0000	C.00042	0.00042	C.00042	0.00043	0.00043	C.00043	0.00043	0.00043	0.00043
10.0000	33.1220	C.00027	C.00027	C.00027	C.00027	C.00027	0.00027	0.00027	0.00027	
10.0000	33.1220	C.00027	C.00027	C.00027	C.00027	C.00027	C.00027	0.00027	0.00027	0.00027
20.0000	66.2441	C.00017	C.00017	C.00017	C.00017	C.00017	C.00017	0.00017	0.00017	
20.0000	66.2441	C.00017	C.00017	C.00017	C.00017	C.00017	C.00017	0.00017	0.00017	0.00017
30.0000	99.3661	0.00011	C.00011	C.00011	C.00011	0.00011	C.00011	0.00011	0.00011	
30.0000	99.3661	C.00011	0.00011	0.00011	C.00011	C.00011	C.00011	0.00011	0.00011	0.00011

ACCUMULATE TIME (MIN) = 480.00

DIRECTION OF FLOW IS FORWARD

0.0000	0.0000	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	
0.0000	0.0000	C.00011	C.00011	0.00011	C.00011	C.00011	C.00011	0.00011	0.00011	0.00011
10.0000	33.1220	C.00007	C.00007	C.00007	C.00007	C.00007	C.00007	0.00007	0.00007	
10.0000	33.1220	C.00007	C.00007	C.00007	C.00007	0.00007	C.00007	0.00007	0.00007	0.00007
20.0000	66.2441	0.00004	C.00004	C.00004	0.00004	0.00004	C.00004	0.00004	0.00004	
20.0000	66.2441	0.00004	0.00004	0.00004	C.00004	C.00004	C.00004	0.00004	0.00004	0.00004
30.0000	99.3661	0.00003	C.00003	C.00003	0.00003	0.00003	C.00003	0.00003	0.00003	
30.0000	99.3661	C.00003	C.00003	C.00003	C.00003	C.00003	C.00003	0.00003	0.00003	0.00003

ACCUMULATE TIME (MIN) = 510.00

DIRECTION OF FLOW IS BACKWARD

0.0000	0.0000	C.00002	C.00002	0.00003	C.00003	C.00003	C.00003	0.00003	0.00003	
0.0000	0.0000	C.00003	C.00003	C.00003	C.00003	C.00003	C.00003	0.00003	0.00003	0.00003
10.0000	33.1220	C.00002	C.00002	C.00002	C.00002	C.00002	C.00002	0.00002	0.00002	
10.0000	33.1220	C.00002	C.00002	C.00002	C.00002	C.00002	C.00002	0.00002	0.00002	0.00002
20.0000	66.2441	C.00001	C.00001	C.00001	C.00001	C.00001	C.00001	0.00001	0.00001	
20.0000	66.2441	C.00001	C.00001	C.00001	C.00001	C.00001	C.00001	0.00001	0.00001	0.00001
30.0000	99.3661	C.00001	C.00001	C.00001	C.00001	C.00001	C.00001	0.00001	0.00001	
30.0000	99.3661	C.00001	C.00001	C.00001	C.00001	C.00001	C.00001	0.00001	0.00001	0.00001

ACCUMULATE TIME (MIN) = 540.00

DIRECTION OF FLOW IS FORWARD

0.0000	0.0000	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	
0.0000	0.0000	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
10.0000	33.1220	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
10.0000	33.1220	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
20.0000	66.2441	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
20.0000	66.2441	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
30.0000	99.3661	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
30.0000	99.3661	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

FINISHED

DIRECTION OF FLOW IS FORWARD

0.0000	0.0000	0.47370	0.47370	0.47370	0.47370	0.47370	0.47370	0.47370	0.47370	
0.0000	0.0000	0.47370	0.47370	0.47370	0.47370	0.47370	0.47370	0.47370	0.47370	0.47370
10.0000	33.1220	0.29793	0.38235	0.43191	0.45584	0.46630	0.47067	0.47247	0.47320	
10.0000	33.1220	0.47350	0.47362	0.47367	0.47369	0.47370	0.47370	0.47370	0.47370	0.47370
20.0000	66.2441	0.18738	0.29262	0.37877	0.43005	0.45500	0.46594	0.47053	0.47241	
20.0000	66.2441	0.47318	0.47349	0.47361	0.47367	0.47369	0.47369	0.47370	0.47370	0.47370
30.0000	99.3661	0.11785	0.21311	0.31681	0.39456	0.43811	0.45861	0.46747	0.47116	
30.0000	99.3661	0.47267	0.47329	0.47353	0.47363	0.47367	0.47369	0.47370	0.47370	0.47370
40.0000	132.4882	0.07412	0.14881	0.25141	0.34880	0.41370	0.44742	0.46269	0.46918	
40.0000	132.4882	0.47186	0.47295	0.47340	0.47358	0.47365	0.47368	0.47369	0.47370	0.47370
50.0000	165.6102	0.04662	0.10057	0.18929	0.29449	0.38004	0.43071	0.45530	0.46607	
50.0000	165.6102	0.47056	0.47243	0.47319	0.47349	0.47362	0.47367	0.47369	0.47369	0.47370
60.0000	198.7322	0.02932	0.06636	0.13589	0.23606	0.33650	0.40657	0.44401	0.46121	
60.0000	198.7322	0.46856	0.47161	0.47285	0.47336	0.47356	0.47364	0.47368	0.47369	0.47370

ACCUMULATE TIME (MIN) 60.00

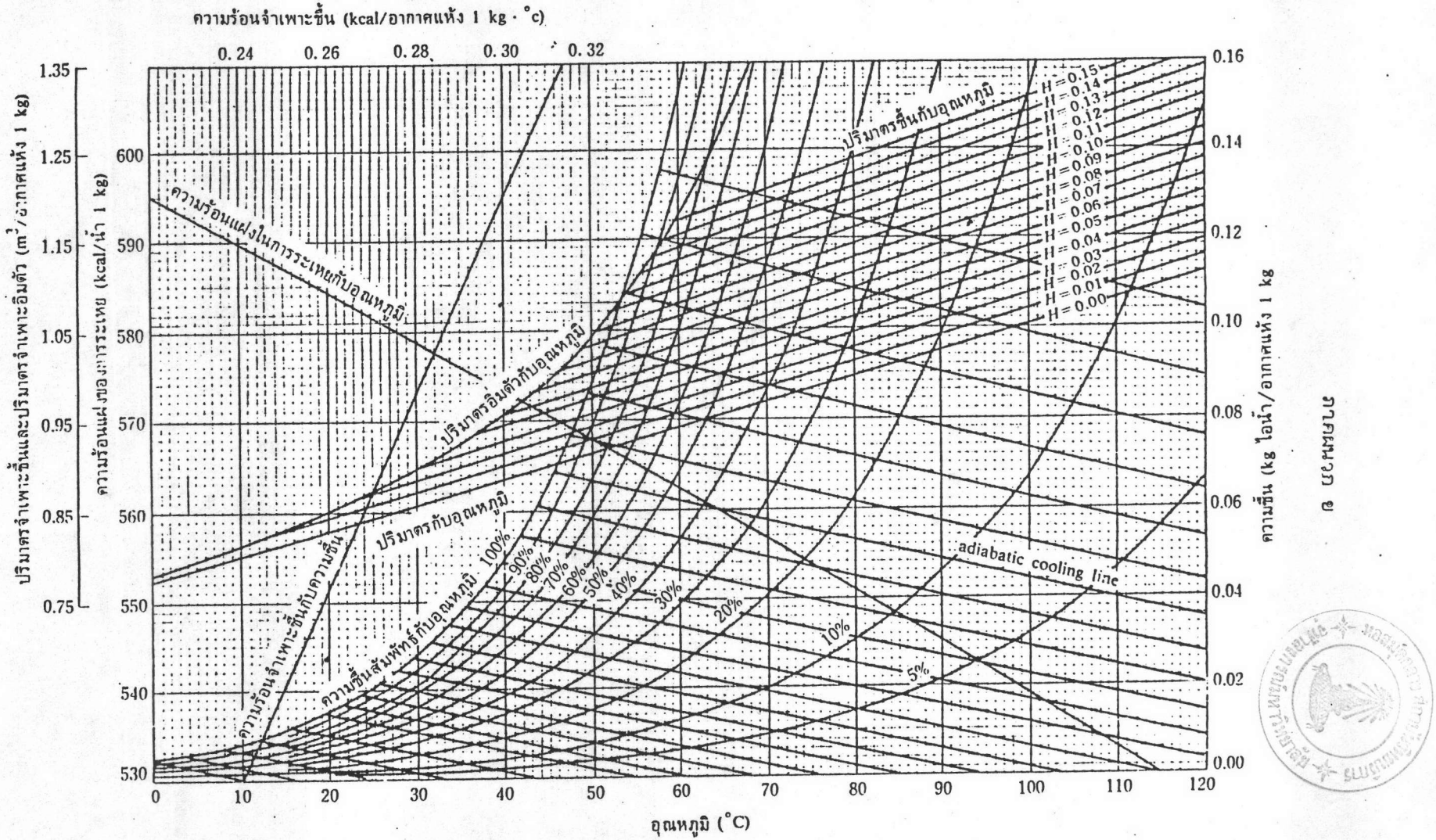
DIRECTION OF FLOW IS BACKWARD

0.0000	0.0000	0.02932	0.06636	0.13589	0.23606	0.33650	0.40657	0.44401	0.46121	
0.0000	0.0000	0.46856	0.47161	0.47285	0.47336	0.47356	0.47364	0.47368	0.47369	0.47370
10.0000	33.1220	0.15993	0.20727	0.26976	0.33872	0.39657	0.43300	0.45149	0.45978	
10.0000	33.1220	0.46216	0.46433	0.46424	0.46279	0.45878	0.44897	0.42638	0.37925	0.29793
20.0000	66.2441	0.15993	0.20727	0.26976	0.33871	0.39657	0.43298	0.45144	0.45963	
20.0000	66.2441	0.46285	0.46257	0.46236	0.45821	0.44783	0.42393	0.37451	0.29030	0.18738
30.0000	99.3661	0.15993	0.20727	0.26976	0.33871	0.39655	0.43295	0.45135	0.45943	
30.0000	99.3661	0.46236	0.46236	0.45940	0.45112	0.43146	0.38940	0.31382	0.21214	0.11785
40.0000	132.4882	0.15993	0.20727	0.26976	0.33870	0.39652	0.43290	0.45123	0.45911	
40.0000	132.4882	0.46158	0.46044	0.45478	0.44028	0.40776	0.34475	0.24952	0.14834	0.07412
50.0000	165.6102	0.15993	0.20727	0.26975	0.33868	0.39650	0.43281	0.45102	0.45851	
50.0000	165.6102	0.46034	0.45743	0.44762	0.42407	0.37501	0.29160	0.18821	0.10035	0.04662
60.0000	198.7322	0.15993	0.20726	0.26974	0.33866	0.39644	0.43268	0.45070	0.45781	
60.0000	198.7322	0.45838	0.45273	0.43668	0.40063	0.33254	0.23419	0.13534	0.06627	0.02932

ACCUMULATE TIME (MIN) 120.00

DIRECTION OF FLOW IS FORWARD

0.0000	0.0000	0.15993	0.20726	0.26974	0.33866	0.39644	0.43268	0.45070	0.45781	
0.0000	0.0000	0.45838	0.45273	0.43668	0.40063	0.33254	0.23419	0.13534	0.06627	0.02932
10.0000	33.1220	0.10059	0.11597	0.14269	0.18631	0.24810	0.31731	0.37605	0.41474	
10.0000	33.1220	0.43530	0.44297	0.44022	0.42481	0.39069	0.33494	0.26764	0.20614	0.15931
20.0000	66.2441	0.06326	0.07835	0.10375	0.14622	0.21014	0.28730	0.35705	0.40476	
20.0000	66.2441	0.43066	0.44094	0.43936	0.42445	0.39054	0.33487	0.26761	0.20613	0.15930
30.0000	99.3661	0.03979	0.05169	0.07236	0.10895	0.16902	0.24973	0.33050	0.38995	
30.0000	99.3661	0.42347	0.43776	0.43801	0.42388	0.39030	0.33477	0.26757	0.20611	0.15929
40.0000	132.4882	0.02503	0.03355	0.04885	0.07752	0.12891	0.20675	0.29555	0.35829	
40.0000	132.4882	0.41253	0.43279	0.43587	0.42298	0.39002	0.33461	0.26749	0.20607	0.15927
50.0000	165.6102	0.01574	0.02153	0.03221	0.05315	0.09360	0.16233	0.25302	0.33331	
50.0000	165.6102	0.39625	0.42511	0.43251	0.42156	0.38932	0.33435	0.26738	0.20601	0.15924
60.0000	198.7322	0.00990	0.01372	0.02090	0.03544	0.06520	0.12100	0.20590	0.29935	



รูป ข1 รูปกราฟความชื้นในหน่วยมวล (มาตรฐาน : ความดันรวม 760 mm Hg , อากาศแห้ง 1 kg)

ภาคผนวก ค-1

วิธีคำนวณปริมาณความชื้นของวัสดุ

การคำนวณหาปริมาณความชื้นของวัสดุทำได้ดังนี้

จากข้อมูลการทดลองที่เวลา t_1

น้ำหนักวัสดุ = X_1 กรัม

น้ำหนักวัสดุแห้ง = X_2 กรัม

น้ำหนักน้ำที่มีอยู่ในวัสดุ = $X_1 - X_2$ กรัม

ปริมาณความชื้นของวัสดุที่เวลา t_1 = $\frac{X_1 - X_2}{X_2}$ กก.น้ำ/กก.วัสดุแห้ง

ภาคผนวก ค-2

วิธีคำนวณอัตราการอบแห้ง

$$\text{อัตราการอบแห้ง} = \frac{\text{น้ำหนักของน้ำที่ระเหยไปในช่วงเวลาลั้น ๆ}}{\text{น้ำหนักของวัสดุแห้ง} \times \text{ช่วงเวลานั้น}}$$

นอกจากการใช้ความสัมพันธ์ข้างต้นแล้ว อัตราการอบแห้งยังหาได้จากการลากเส้นสัมผัสกับเส้นกราฟที่พลอตระหว่างความชื้นกับเวลาแล้วอ่านความชันของเส้นสัมผัสนั้น

ในงานวิจัยนี้การหาอัตราการอบแห้งจะใช้วิธีหลัง

ภาคผนวก ง

ภาคผนวกนี้แสดงขั้นตอนการคำนวณอัตราการอบแห้งเชิงทฤษฎี (R_{theo}) เพื่อกำหนดค่า c_c ที่เหมาะสมที่สุดโดยการเปรียบเทียบกับอัตราการอบแห้งที่ได้จากการทดลอง

วัสดุ : ขี้นมันสำปะหลังขนาด 0.5 ซม. x 0.5 ซม. x 0.3 ซม

อุณหภูมิเข้าของลมร้อน 65°ซ

ความเร็วของลมร้อน 0.6 ม/วินาที

ความชื้นของลมร้อน 0.018 กก.น้ำ/กก.อากาศแห้ง

อัตราส่วนว่างของขี้นวัสดุ 0.768

ความหนาแน่นจริงของวัสดุแห้ง 924 กก./ลบ.ม.

เส้นผ่าศูนย์กลางสมมูลของขี้นวัสดุ 0.409×10^{-2} ม.

ความชื้นแรกเริ่ม 0.80 กก.น้ำ/กก.วัสดุแห้ง

ความชื้นสมดุลย์ 0.00 กก.น้ำ/กก.วัสดุแห้ง

ก่อนอื่นสมมุติว่าลมร้อนที่ออกจากขี้นวัสดุมีอุณหภูมิ = 30°ซ และมีความชื้น = 0.032 กก.น้ำ/กก.อากาศแห้ง จากแผนภูมิความชื้น ลมร้อนอุณหภูมิ 65°ซ ความชื้น 0.018 กก.น้ำ/กก.อากาศแห้ง จะมีปริมาตรจำเพาะ (v_H) = 1.02 ลบ.ม./กก.อากาศแห้ง

ความเร็วเชิงมวลของลมร้อน (G) $= \dfrac{0.6(3600)\left\{1+\left(\dfrac{0.018+0.032}{2}\right)\right\}}{1.02}$

$= 2170$ กก./ตร.ม.ชม.

ที่อุณหภูมิ 65°ซ ความหนืด (μ) ของอากาศ = 0.023 เซนติพอยซ์

$= 7.2 \times 10^{-2}$ กก./ม.ชม.

ดังนั้น

$$Rep = \frac{GD_p}{\mu} = \frac{2170 \times 0.409 \times 10^{-2}}{7.2 \times 10^{-2}} = 123.2$$

จาก

$$\frac{k}{G} = 2.566\ (\overline{Rep})^{0.51}$$

เราได้

$$k = 2.566(123.2)^{-0.51} \times 2170 = 477.83 \text{ กก./ตร.ม.ชม.}$$

จาก

$$a = 6(1-\varepsilon)/D_p$$
$$= 6(1-0.768)/0.409 \times 10^{-2}$$
$$= 340.34 \text{ ม}^{-1}$$
$$ka = 477.83 \times 340.34$$
$$= 162,626 \text{ กก./ชม.ลบ.ม.}$$

อนึ่งลมร้อนที่อุณหภูมิ 65°ซ ความชื้น 0.018 กก.น้ำ/กก.อากาศแห้ง มีอุณหภูมิกระเปาะเปียก = 32.8°ซ และความชื้นอิ่มตัวที่อุณหภูมิกระเปาะเปียก = 0.032 กก.น้ำ/กก.อากาศแห้ง

จาก

$$\xi_L = \ln\left\{\frac{H_w - H_i}{H_w - H_L}\right\}$$

โดยที่

$$\xi_L = \frac{kaL}{G_o} \quad ; \quad G_o = \frac{G}{1 + H_i}$$

H_i = ความชื้นของลมร้อนก่อนเข้าชั้นวัสดุ

H_L = ความชื้นของลมร้อนที่ออกจากชั้นวัสดุ

H_w = ความชื้นของลมร้อนที่อุณหภูมิกระเปาะเปียก

ดังนั้น

$$\xi_L = \frac{162,626 \times 0.05}{2170/(1+0.018)} = 3.82$$

จาก

$$H_L = H_w - \frac{(H_w - H_i)}{\ell^{\xi_L}}$$

$$H_L = 0.032 - \frac{(0.032 - 0.018)}{\ell^{3.82}}$$

หรือ

$H_L = 0.0316$ ซึ่งใกล้เคียงกับที่เราได้สมมุติไว้ตอนแรก

ดังนั้น

$$\pi_o = H_w - H_i = 0.032 - 0.018 = 0.014$$

และ

$$R_{theo} = -\frac{dw}{d\theta} = \frac{ka}{(1-\varepsilon)\rho_s} \cdot \frac{\pi_o \ell^{-\pi_o \tau (1-\ell^{\phi_o \xi_L})}}{\xi_L \; 1-\ell^{-\pi_o \tau (1-\ell^{\phi_o \xi_L})}}$$

โดยที่ $\tau = ka\theta / (1-\varepsilon)\rho_s (c_c - c_e)$

$\phi = (c-c_c)/(c_c-c_e)$

หลังจากการแทนค่าต่าง ๆลงไปในสมการข้างต้นเราจะเห็นว่าเหลือเพียงตัวแปร θ และ c_c ที่ต้องรู้ในการคำนวณค่า R_{theo}

โดยการทดลองใช้ C_c ค่าหนึ่งเราจะได้ค่า R_{theo} ที่เวลา θ ต่าง ๆ ซึ่งเอาไปเปรียบเทียบกับอัตราการอบแห้งที่ได้จากการทดลองได้ สรุปแล้วค่า C_c ที่เหมาะสมที่สุดคือค่าที่ทำให้ผลรวมของกำลังสองของผลต่างระหว่าง R_{theo} และ R_{exp} มีค่าน้อยที่สุดนั่นเอง

ประวัติการศึกษา

นายกมลรัตน์ พันธุ์อารยะ เกิดวันที่ 26 สิงหาคม พ.ศ. 2502 ที่กรุงเทพฯ สำเร็จการศึกษาวิทยาศาสตร์บัณฑิต (สาขาเคมี) เกียรตินิยมอันดับหนึ่ง จากคณะวิทยาศาสตร์ สถาบันเทคโนโลยีพระจอมเกล้า วิทยาเขตธนบุรี พ.ศ.2524 และเข้าศึกษาต่อในระดับปริญญามหาบัณฑิต ภาควิชาวิศวกรรมเคมี คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ในปี พ.ศ. 2525