Smart Drying System for Agricultural Materials

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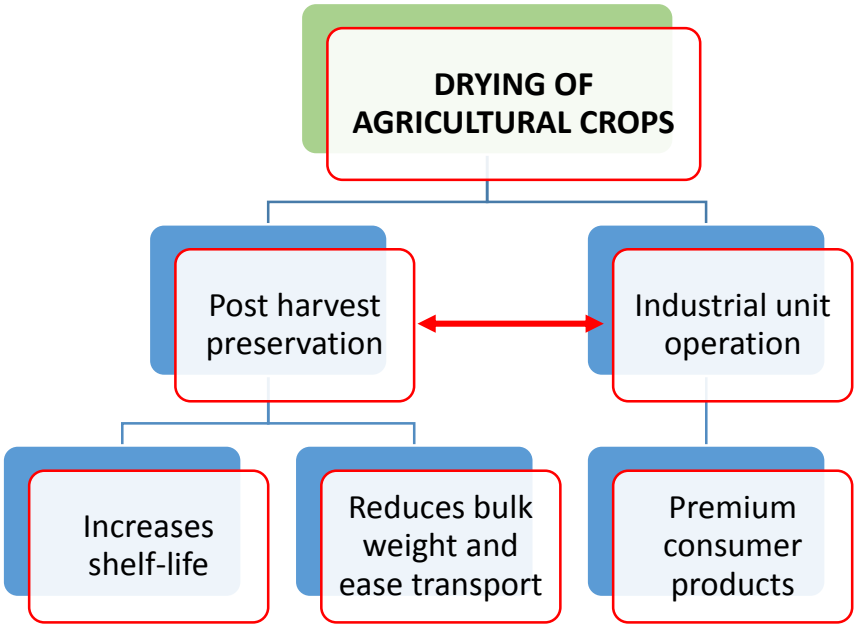
Background


DRYING OF AGRICULTURAL CROPS
Post harvest preservation
Industrial unit operation
Increases shelf-life
Reduces bulk weight and ease transport
Premium consumer products

Problem Statement

Global energy demand

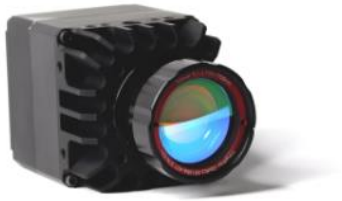
40%

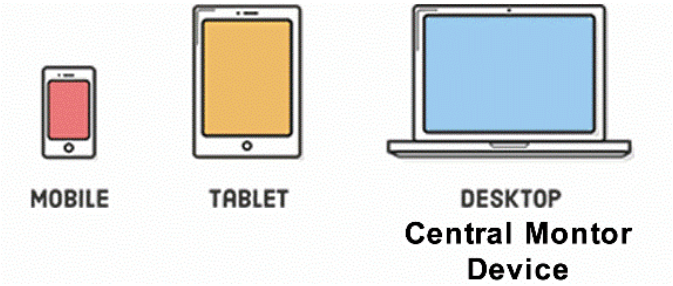
50%

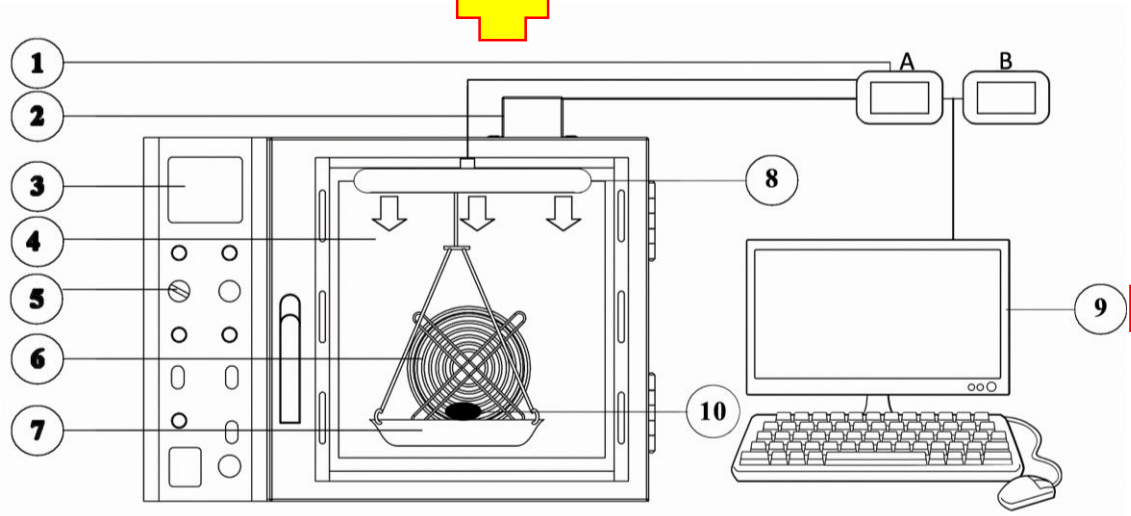
2030

Aim

- To develop smart drying system for agricultural materials

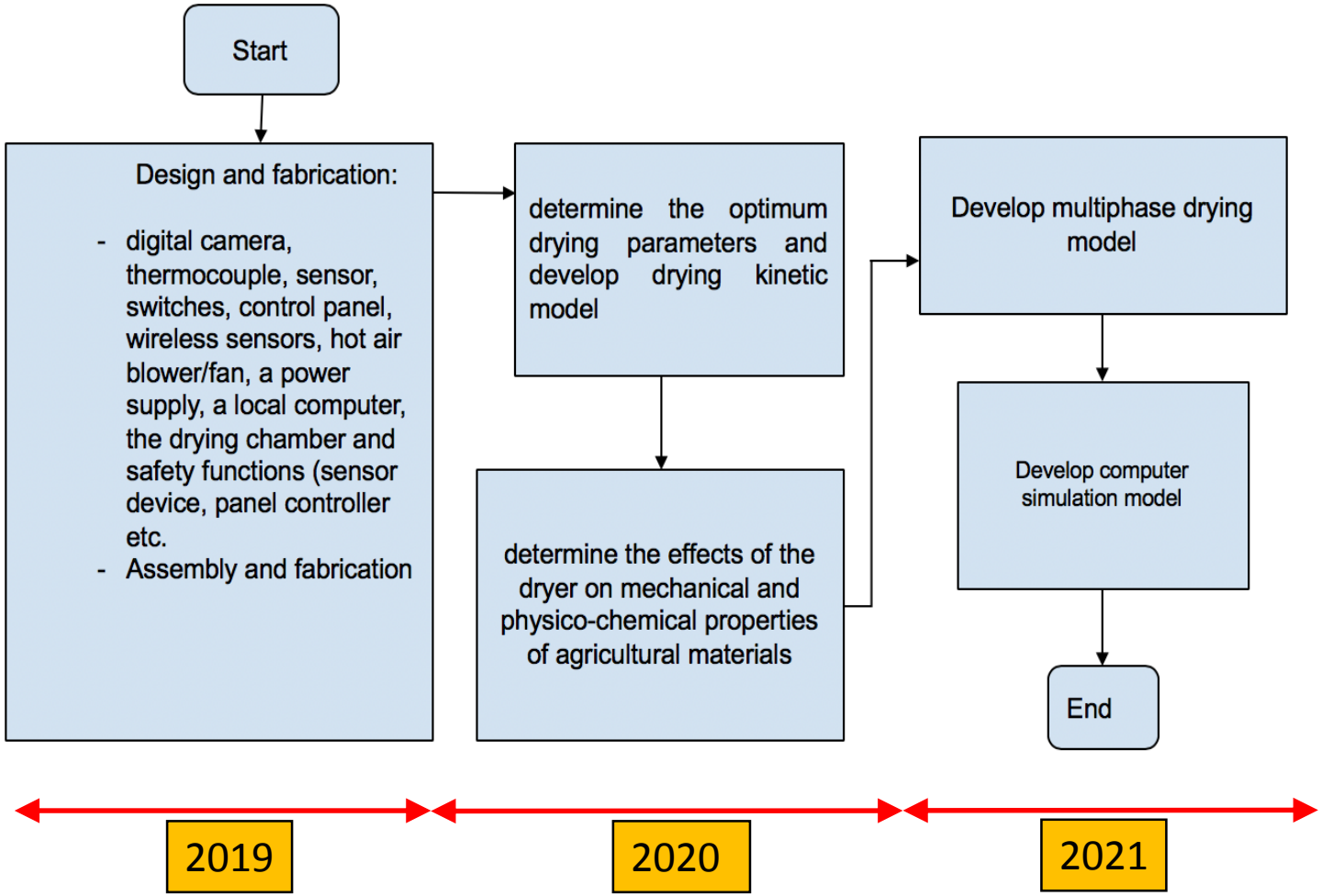






1A= Digital control panel for entire drying system; 1B = control panel for infrared glass emitter with power controller; 2=load cell; 3= display board; 4 = drying chamber; 5 = on/off button; 6 = fan/blower; 7 = drying tray; 8 = IR glass heater (IR intensity= 1100 W/m^2); 9 = computer monitor; 10 = sweet potato slice sample.

Methodology

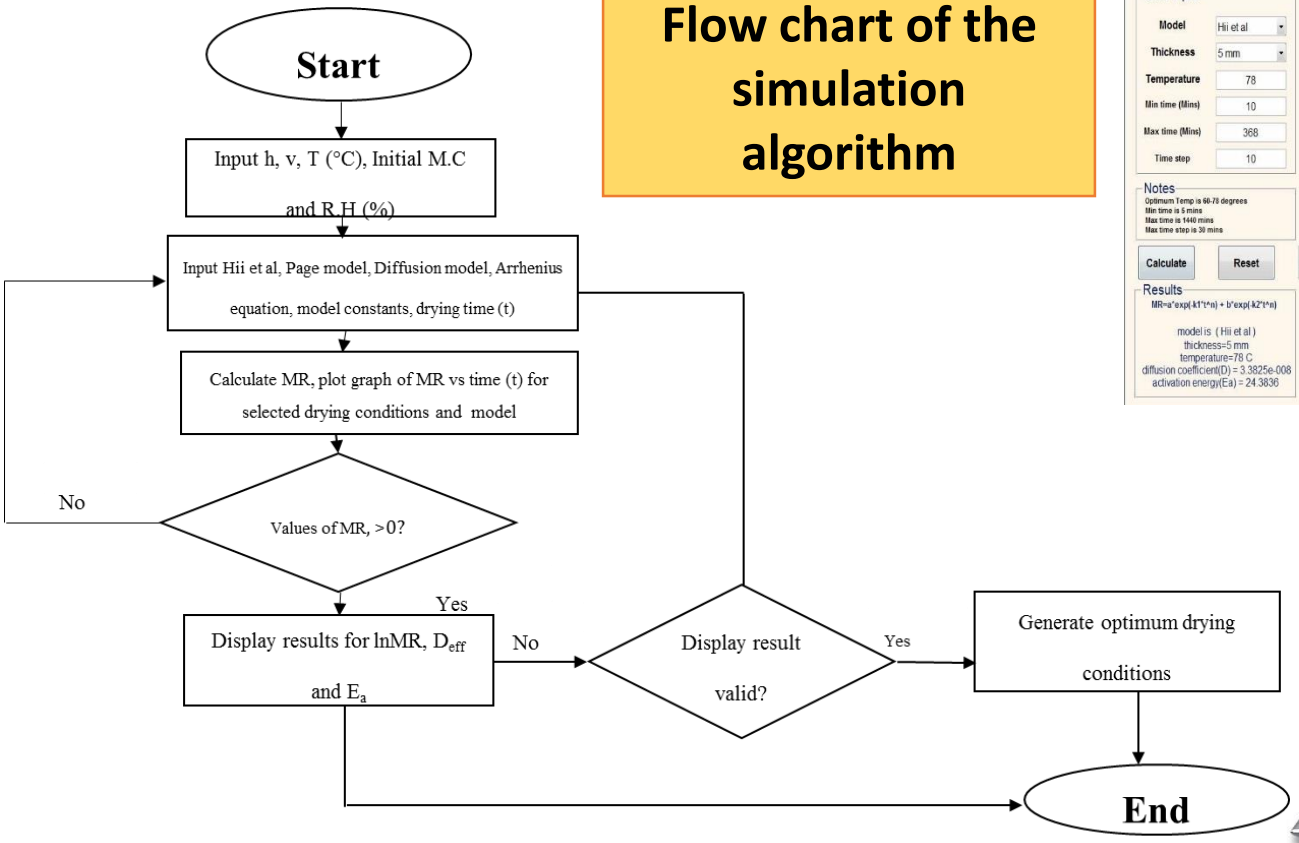


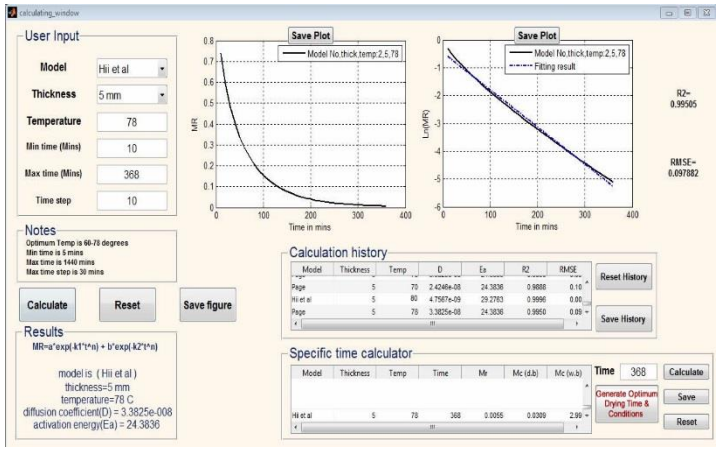
The flowchart and time frame of the proposed project

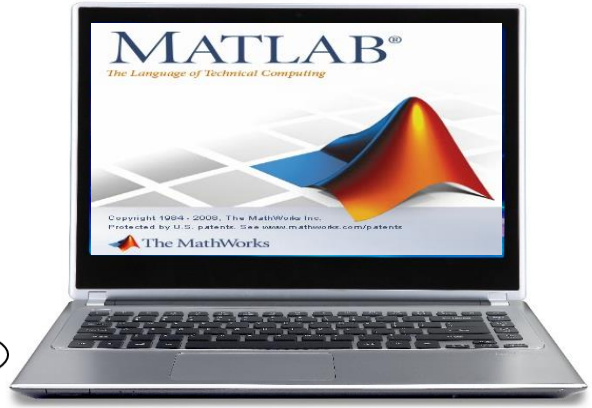
Fundamental study:
Related Project 1

- Computer simulation of the drying kinetics of pumpkin (*Cucurbita moschata*) during convective hot air drying

Flow chart of the simulation algorithm



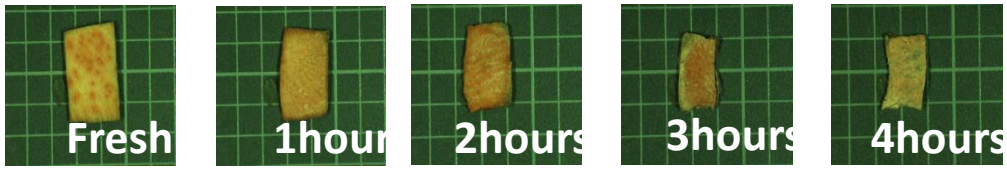




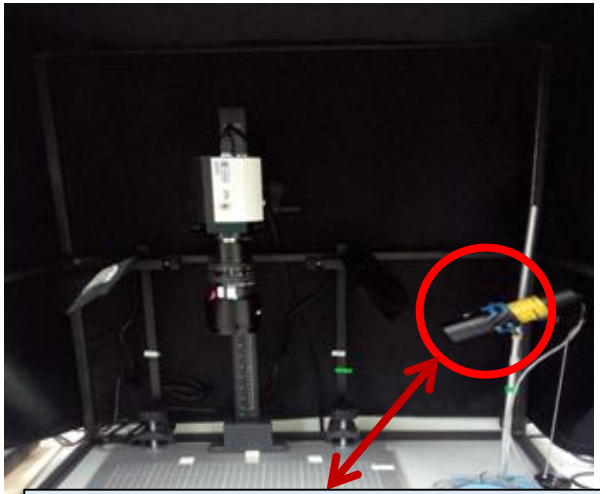
Related Project 2

- Computer vision and backscattering imaging for predicting MC and colour changes of sweet potatoes during drying

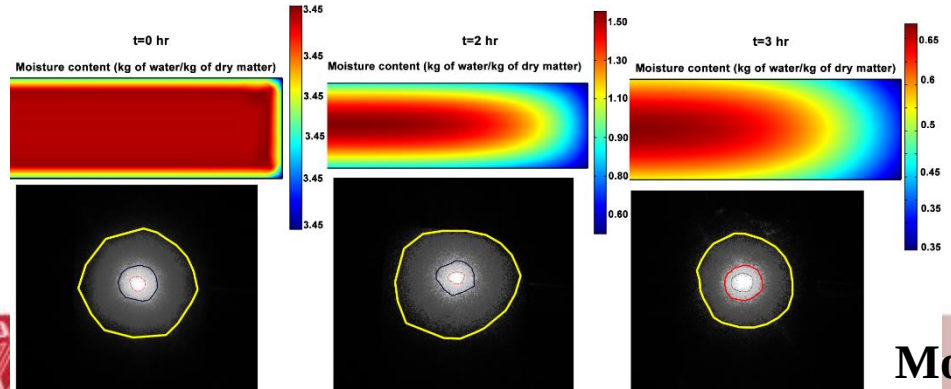
Digital images captured during drying



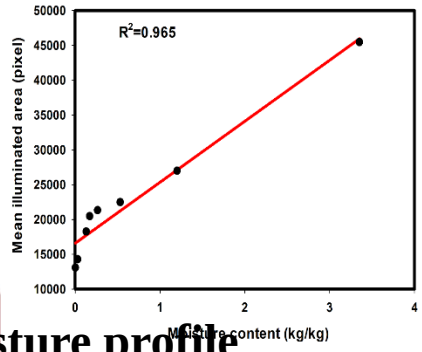
Backscattered images captured during drying

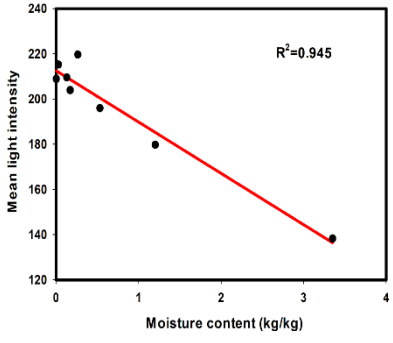


A laser diode emitting at 658 nm with 30 mW maximum power



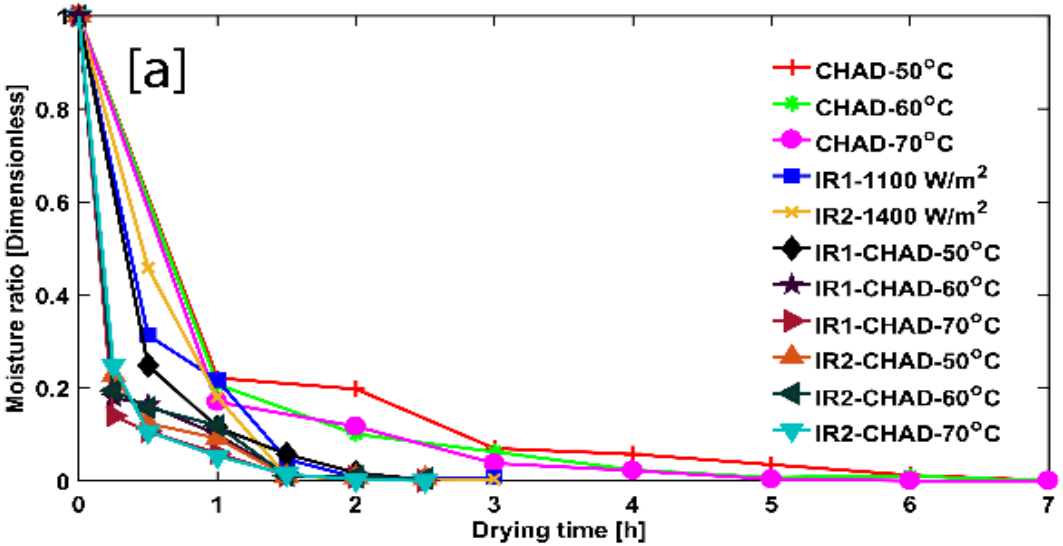
Moisture profile





Related Project 3

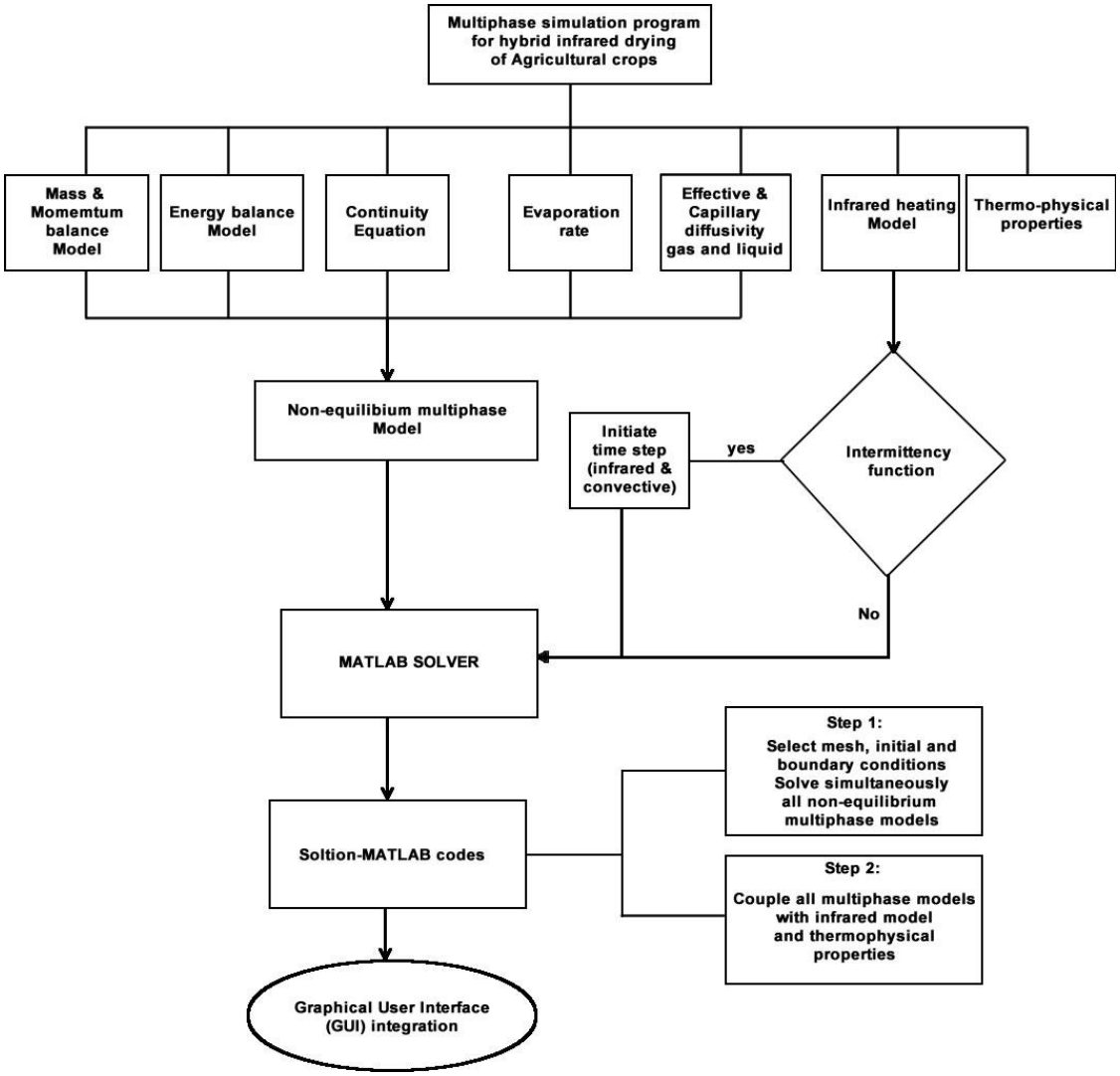
- Combined IR and HAD

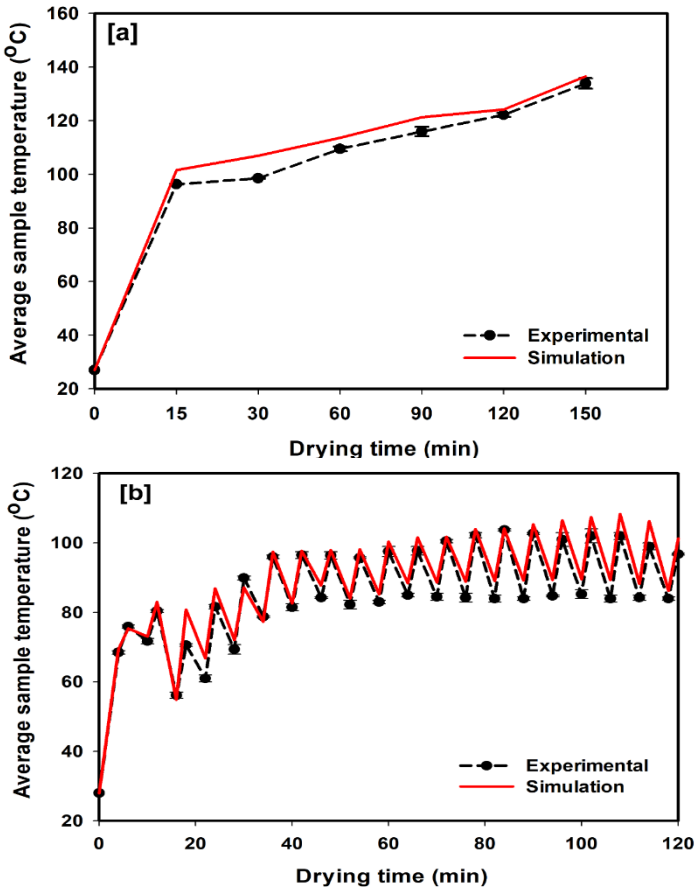


Images of fresh and dried sweet potato for different infrared and hot-air combination strategies; [a] Fresh sample; [b] IR-HAD; [c] HAD+IR; [d] IR+HAD; [e] IIR+HAD.

Related Project 4

- A multiphase simulation software for the drying of agricultural crops





Average simulated and experimental temperature for sweet potato during drying; [a] IR-HAD; [b] IIR+HAD

Budget Estimation

Type of costs		Year 1 (USD)	Year 2 (USD)	Year 3 (USD)	TOTAL (USD)
Personnel costs	Postgraduate student (s)	5040	5040	5040	15120
Equipment and consumable costs	Facilities	200	200	200	600
	Stationeries	100	100	100	300
	Server and maintenance fees	1000	1000	1000	3000
	Workstation	2000			2000
	Dryer design and fabrication	10000			10000
	Imaging system	20000			20000
	Electronic components and sensors	2000	1000	1000	4000
Travel costs					
	Local travel	200	200	200	600
	Oversea travel	5000			5000
Other Costs					
	Equipment maintenance fees	2000	500	500	3000
	Training/ publications/ conference fee	500	1000	500	2000
TOTAL		**48040**	**9040**	**8540**	**65620**

23%

60.8%

8.5%

7.6%

Expected Output

Research	Details/Remark
New/Improved product	Smart Hybrid dryer
New/Improved product	Desktop drying monitoring software
New/Improved product	Mobile drying monitoring software
Method/technique	Combined IR and hot-air drying

Improve drying process:

- Energy and time saving
- Reduce operational cost
- Minimal loss in quality parameters
- Reduce postharvest losses
- Improve and increase upstream production

Thank you

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