FAECAL SLUDGE DRYING USING SOLAR THERMAL ENERGY

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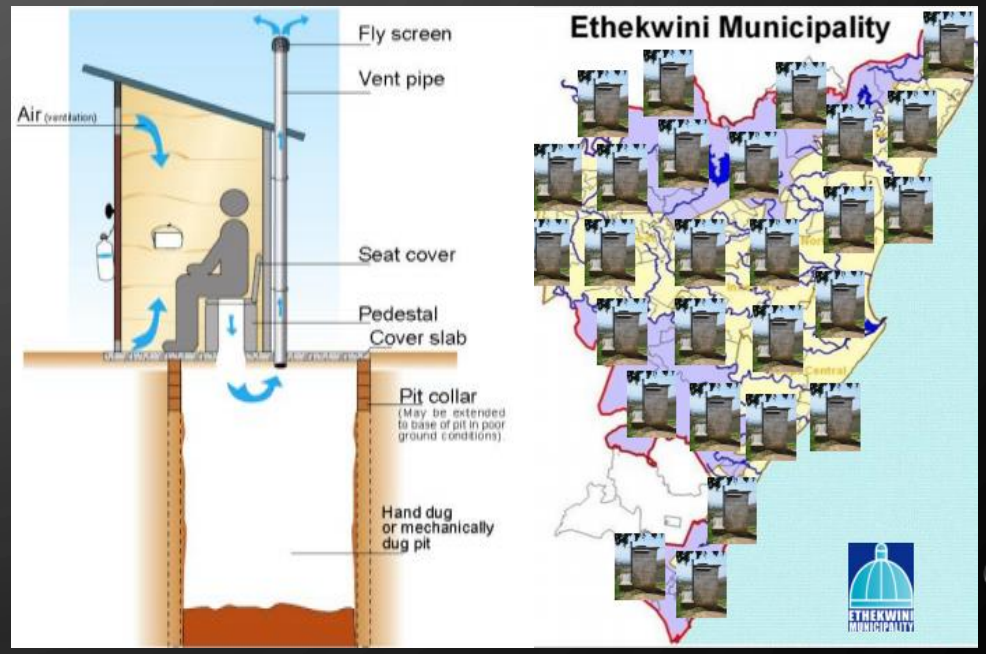
PRG pollution research group

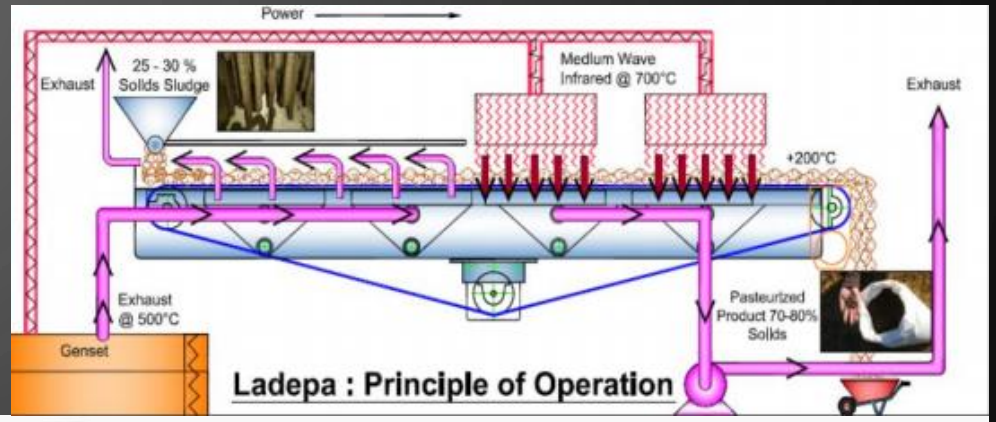
FAECAL SLUDGE (FS)

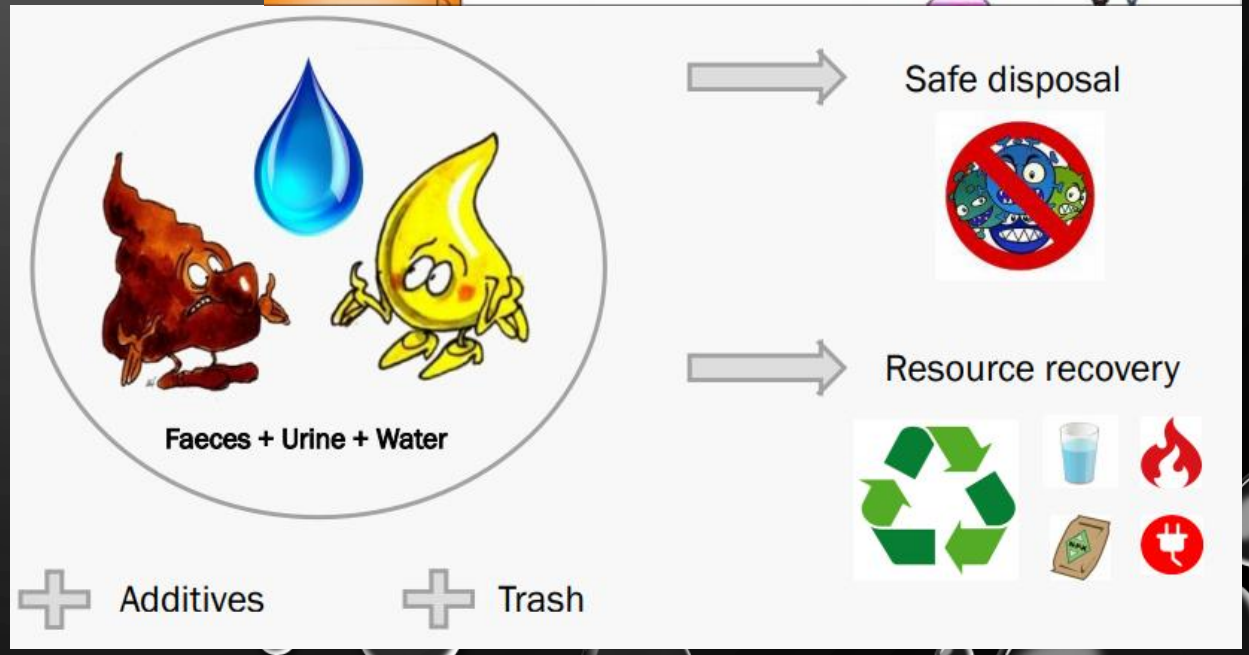
- DECENT SANITATION A BASIC HUMAN RIGHT
- 2 BILLION PEOPLE LACKING SANITATION
- ONSITE AND OFFSITE SANITATION
- FS - CRUDE SLURRY FROM ONSITE SYSTEMS
- HAZARDS:
  - HEALTH HAZARDS
  - CONTAMINATION



TREATMENT

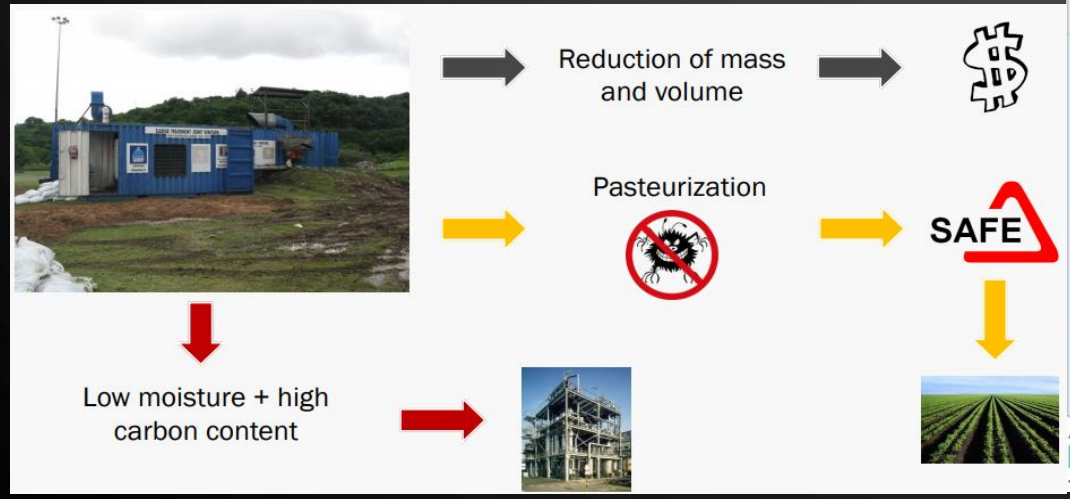
- SOME TREATMENT OPTIONS:
  - WWTP, TRENCHES, LADEPA.
- SOME RE-USE OPTIONS
  - FERTILIZER, ANIMAL FEED, FUEL.
- SOME DRYING METHODS:
  - DRYING BEDS, INFRARED DRYING

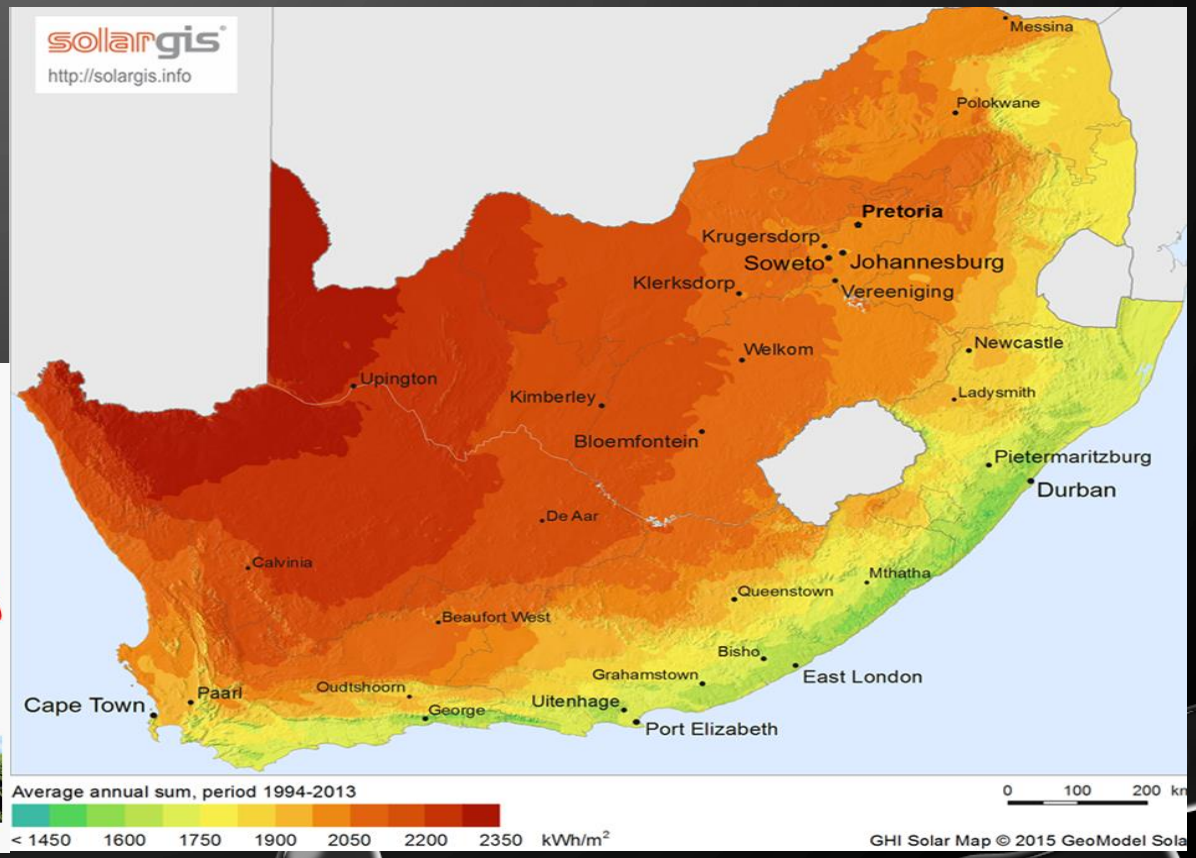




SOLAR DRYING

- DRYING CRITICAL TO FS TREATMENT
- SOLAR ENERGY – ENERGY FROM THE SUN
- LACK OF DATA FOR FS SOLAR DRYING





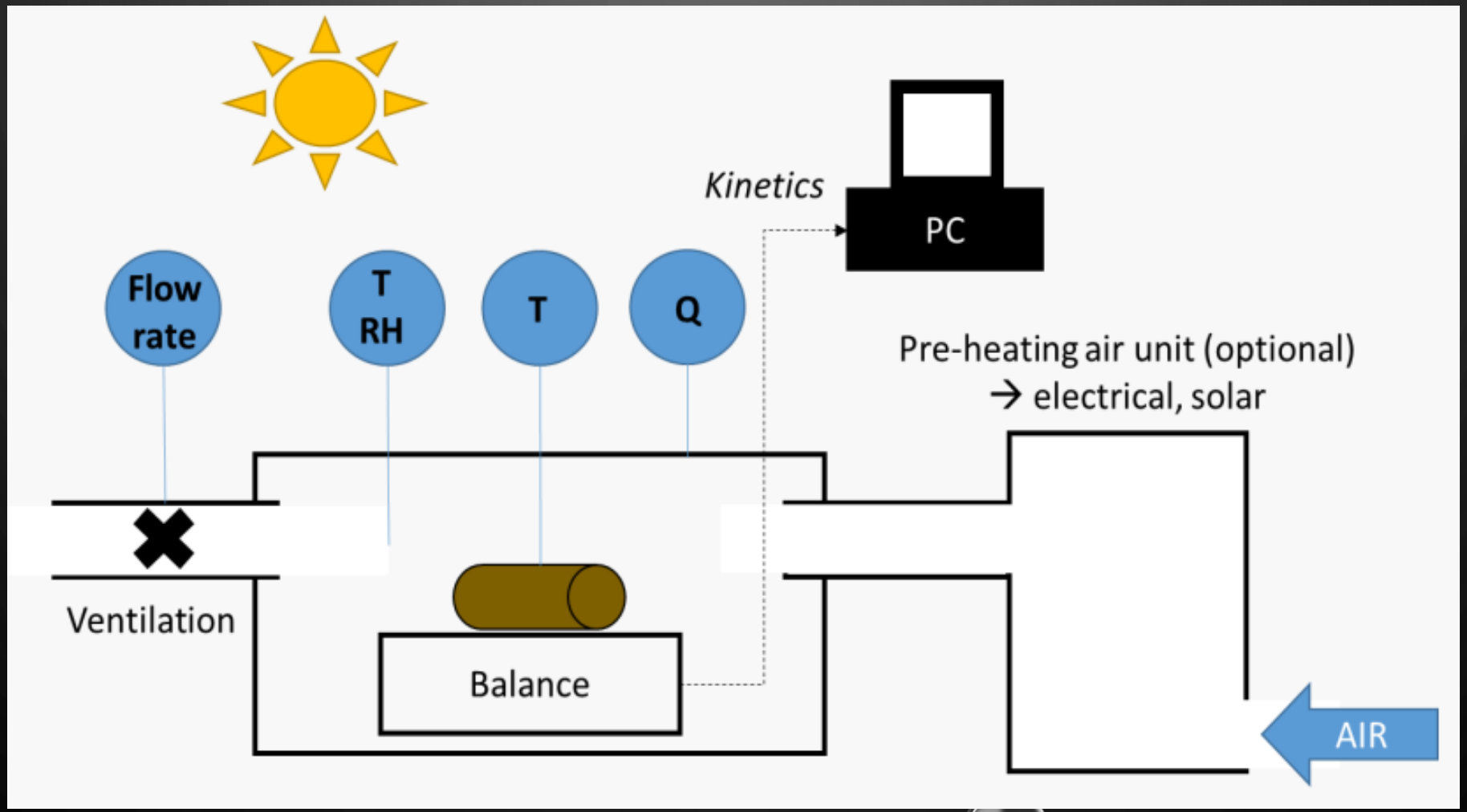
AIMS AND OBJECTIVES

- CHARACTERIZATION OF FS DRYING USING SOLAR THERMAL ENERGY
- FS FROM PIT LATRINES
- OBJECTIVES:
  - DESIGN AND BUILD TESTING RIG
  - EVALUATION OF DRYING CHARACTERISTICS ON CONDITIONS
  - EVALUATION OF QUALITATIVE AND QUANTITATIVE EFFECTS
  - DRYING MODELS

MATERIAL AND METHODS

- FS FROM VIP LATRINES
- ETHEKWINI MUNICIPALITY PIT EMPTYING
- DECONTAMINATED AND STORED IN A COLD ROOM
- SCREENED AND SIEVED

CONCEPT

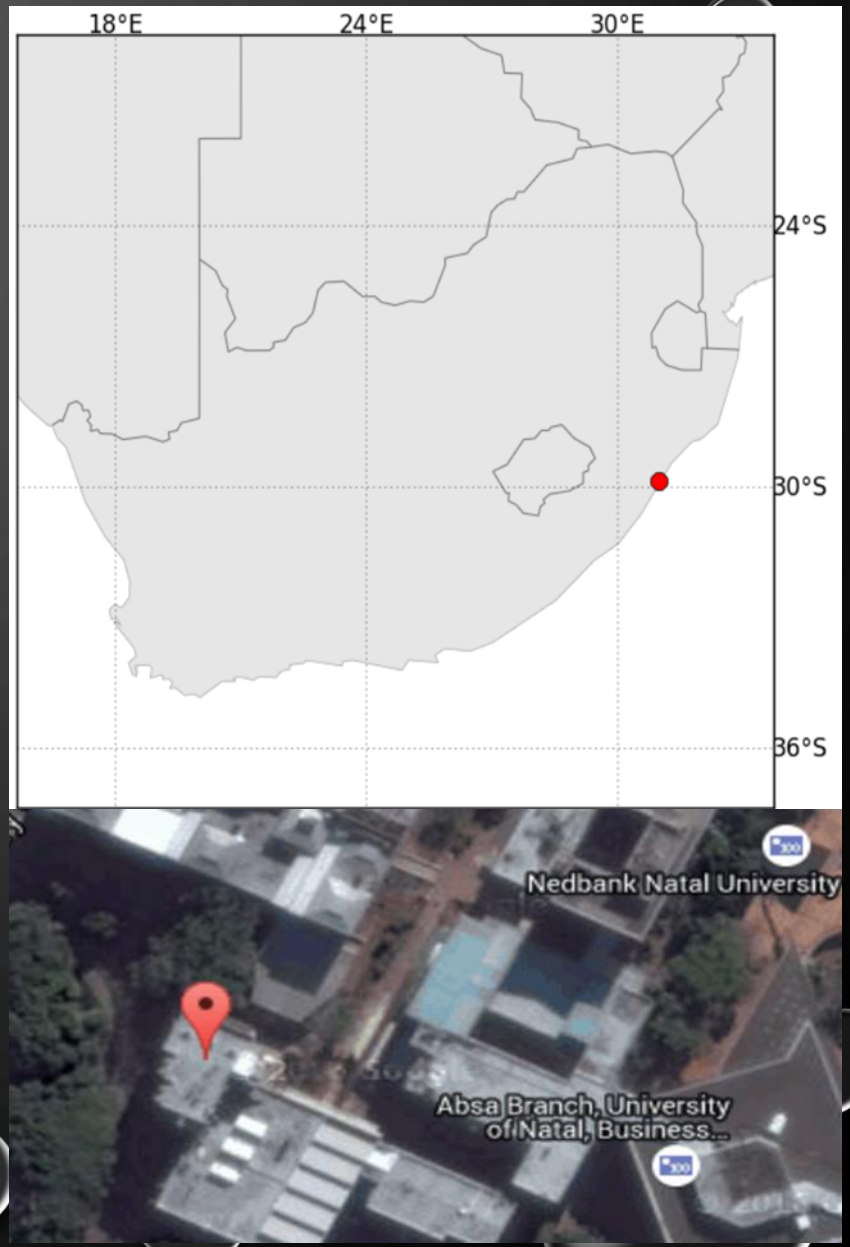

Kinetics
PC
Flow rate
T RH
T
Q
Pre-heating air unit (optional)
→ electrical, solar
Ventilation
Balance
AIR

SETUP


WORK SPACE
DRYING CHAMBER
PYRANOMETER
AIR HEATER
CONTROL LOCATION
DATA LOGGER
TROLLEY

SITE

- SITE NAME: CHEMICAL ENGINEERING BUILDING,
  HOWARD COLLEGE,
  UNIVERSITY OF KWAZULU-NATAL,
  BEREA, SOUTH AFRICA
- COORDINATES: 29° 52' 7.13" S, 30° 58' 46.1" E
- ELEVATION ABOVE SEA LEVEL.: **127 M**

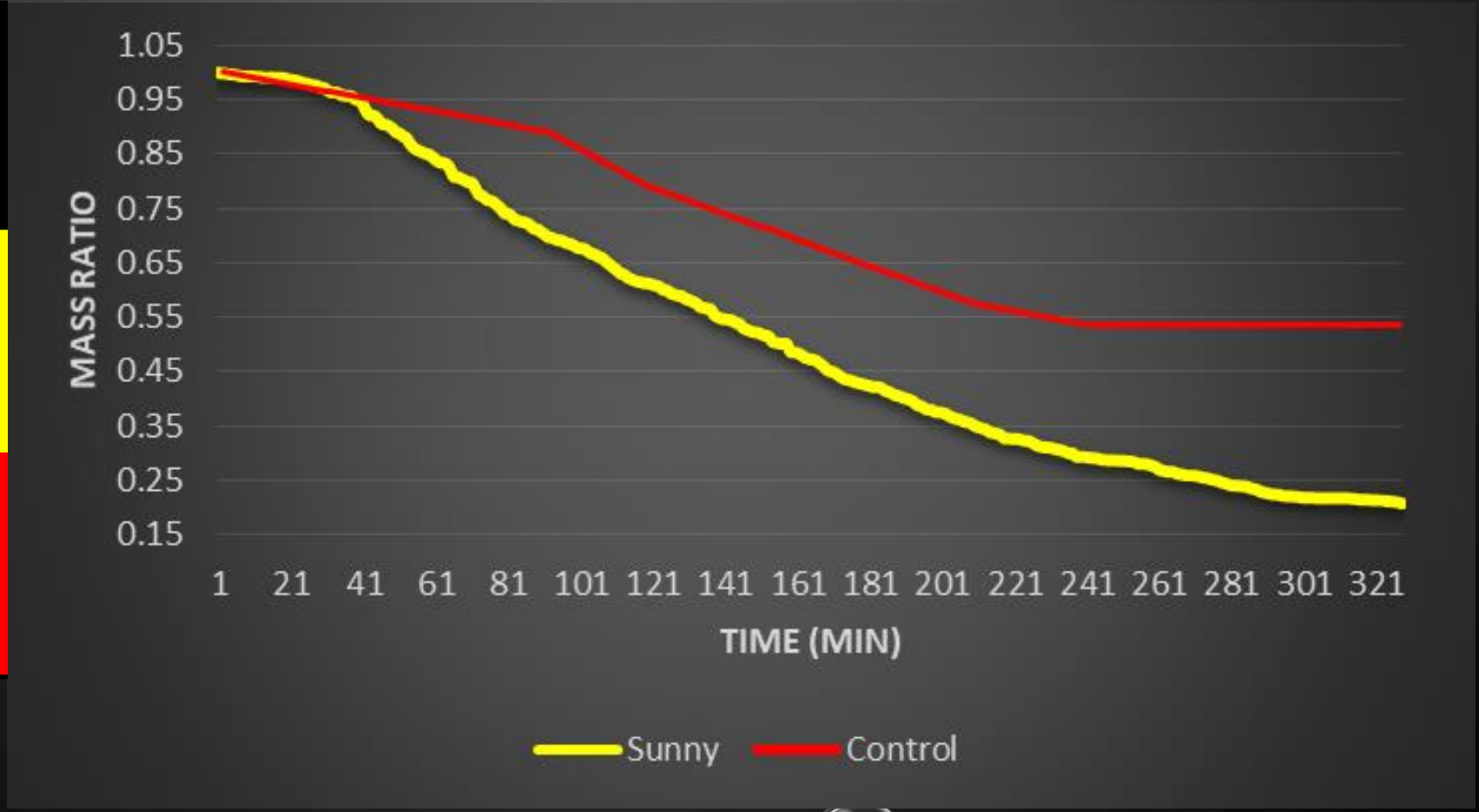


EXPERIMENTAL PLAN

- VARIABLES:
  - WEATHER CONDITIONS, THICKNESS
- MEASUREMENTS:
  - TEMPERATURE, HUMIDITY, MASS, SOLAR IRRADIANCE
- DATA ANALYSIS
  - MASS RATIO
- CONTROL

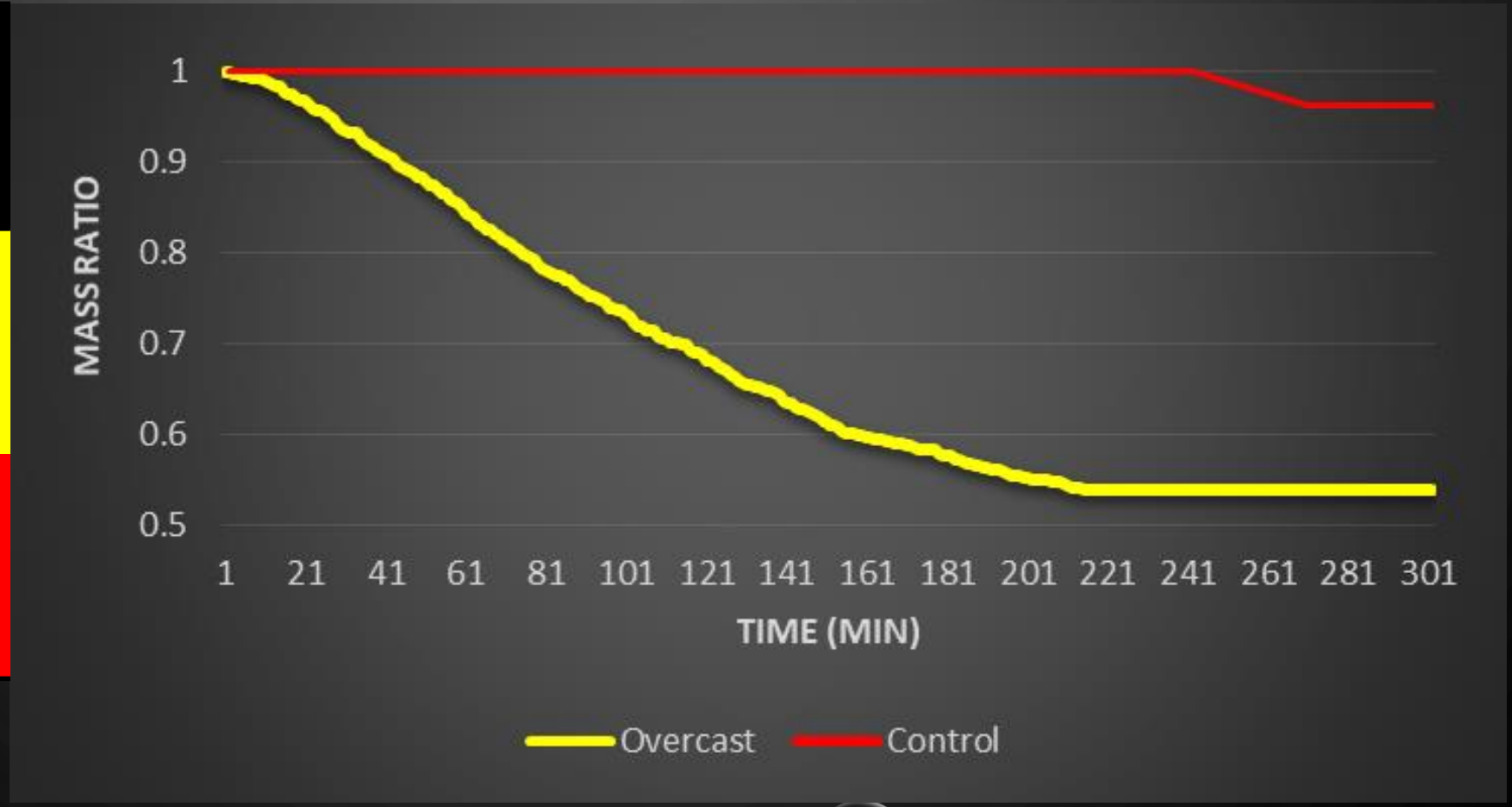
SUNNY

DRYING TEMPERATURE (°C)	
SUNNY	32.71
CONTROL	26.33



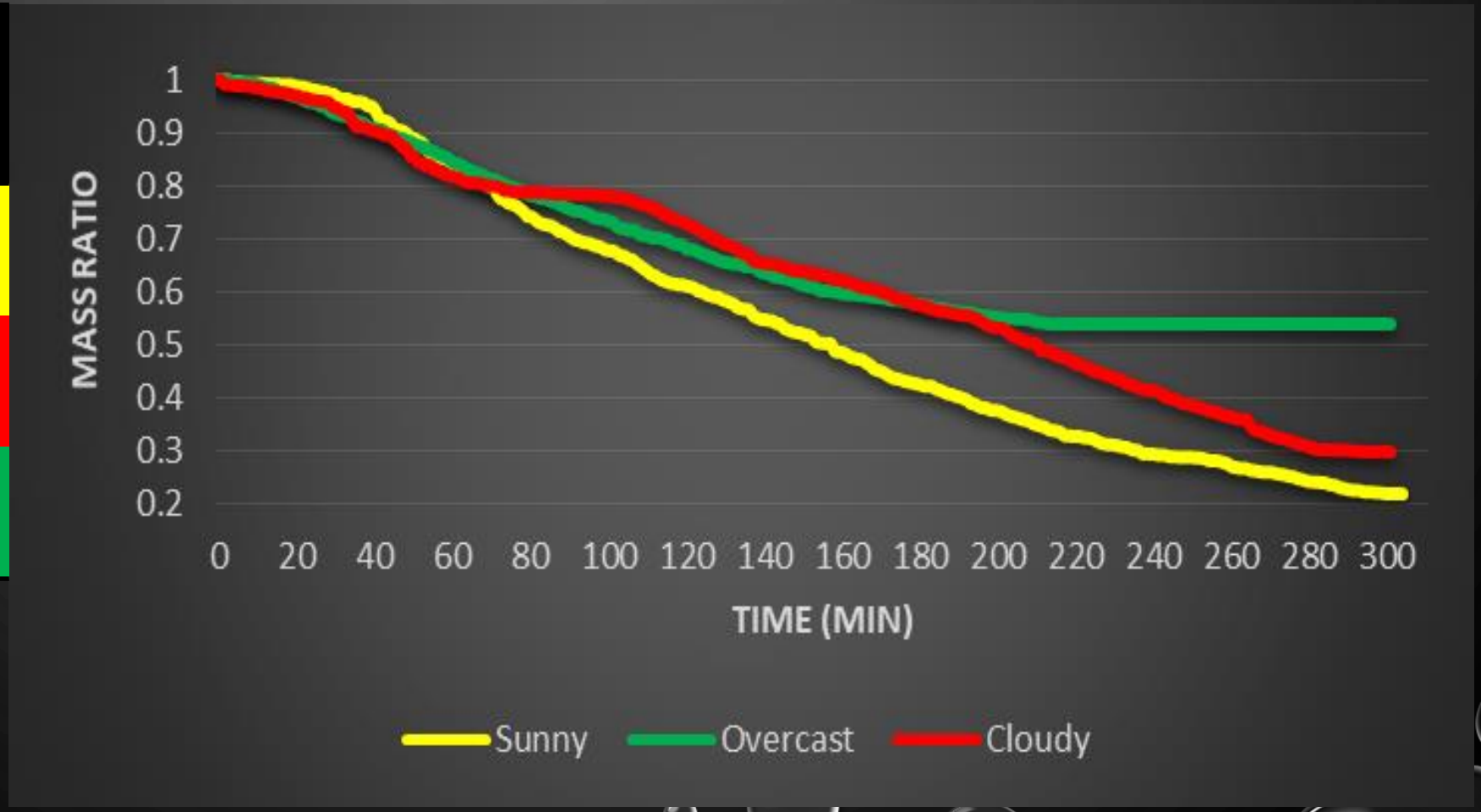
OVERCAST

DRYING TEMPERATURE (°C)	
OVERCAST	17
CONTROL	19



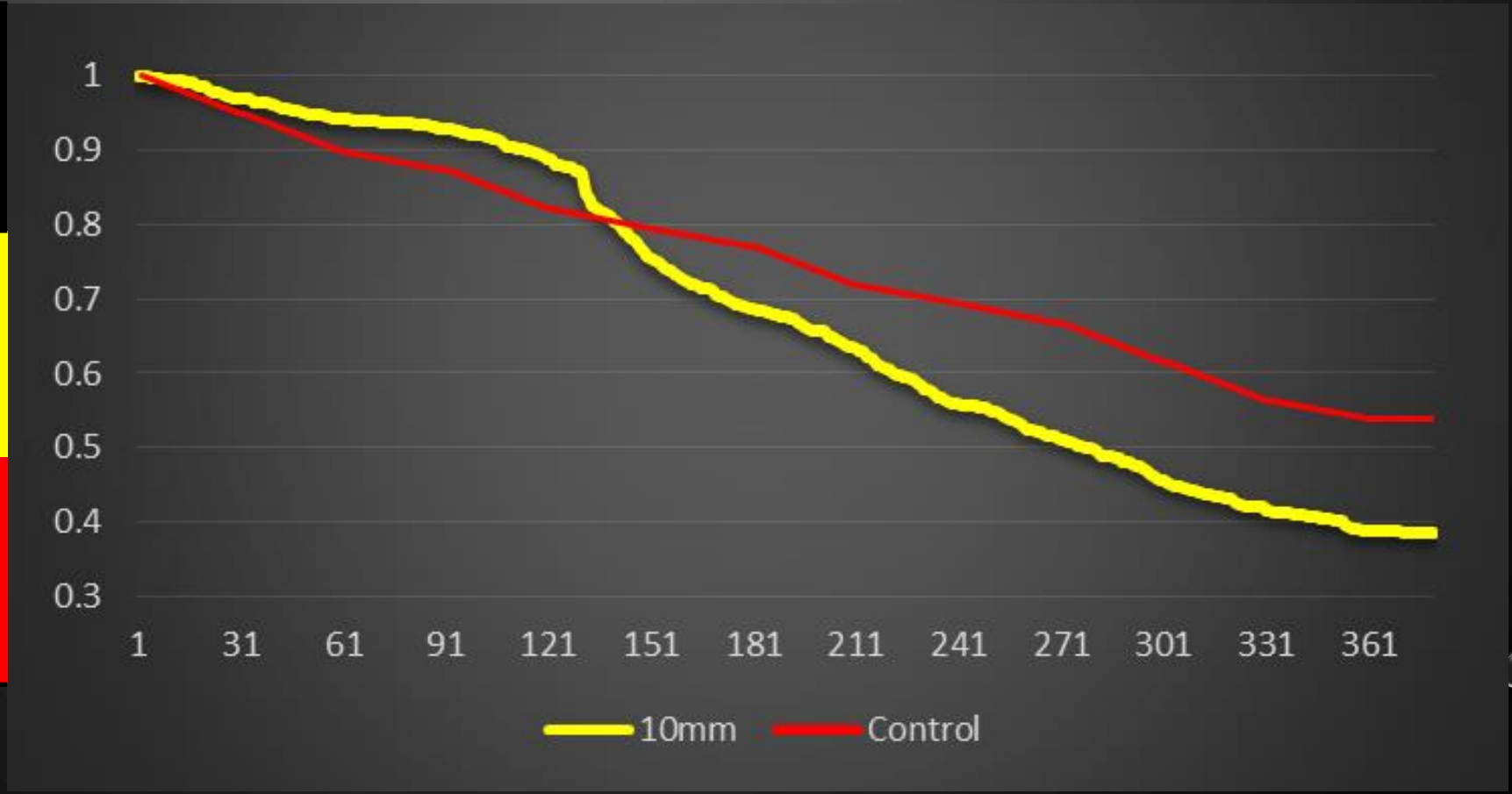
WEATHER CONDITIONS

SOLAR IRRADIANCE (W/M2)	
SUNNY	1004
CLOUDY	559
OVERCAST	100



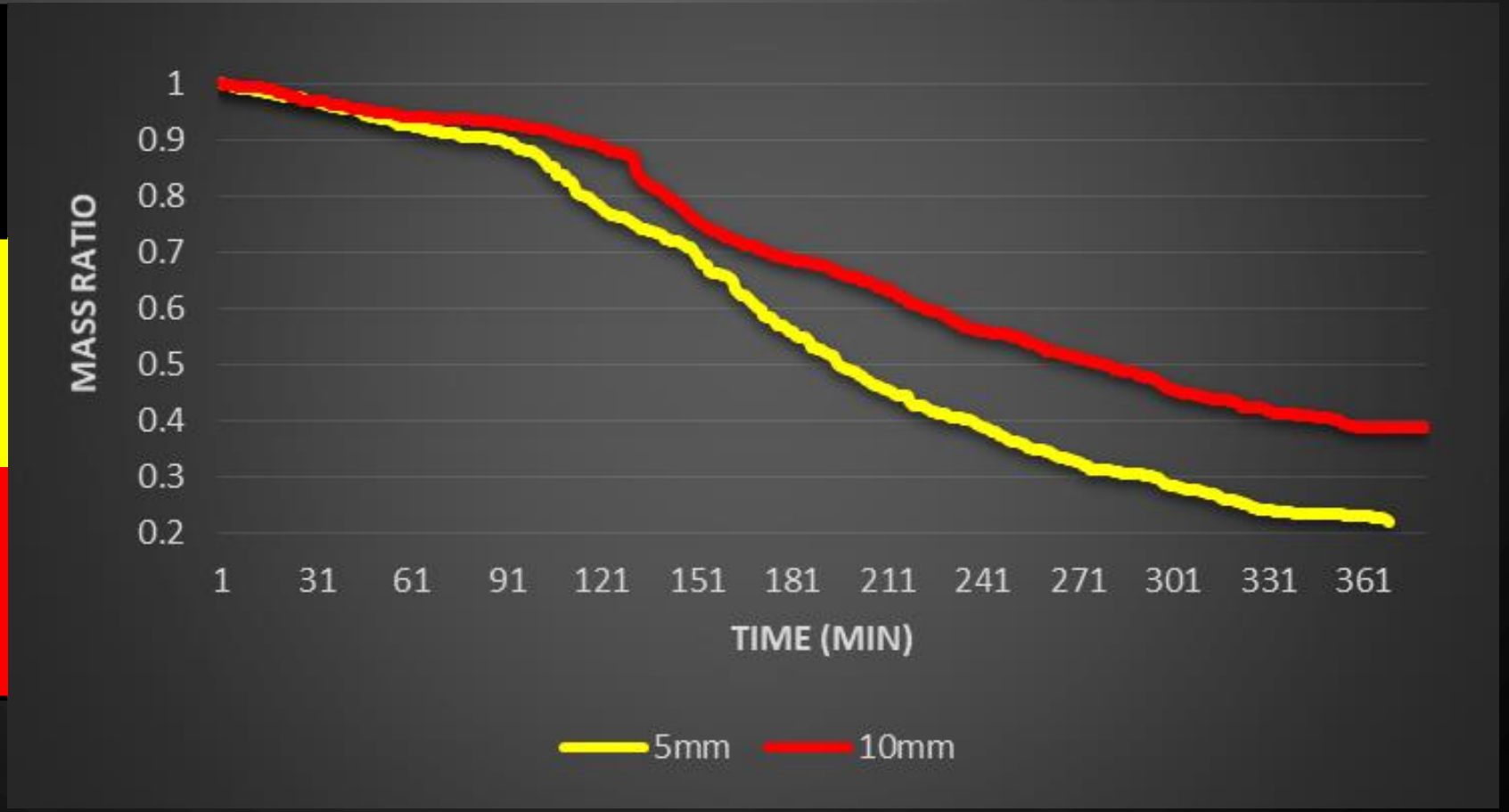
10MM THICKNESS

DRYING TEMPERATURE (°C)	
10MM	32.72
CONTROL	26.32

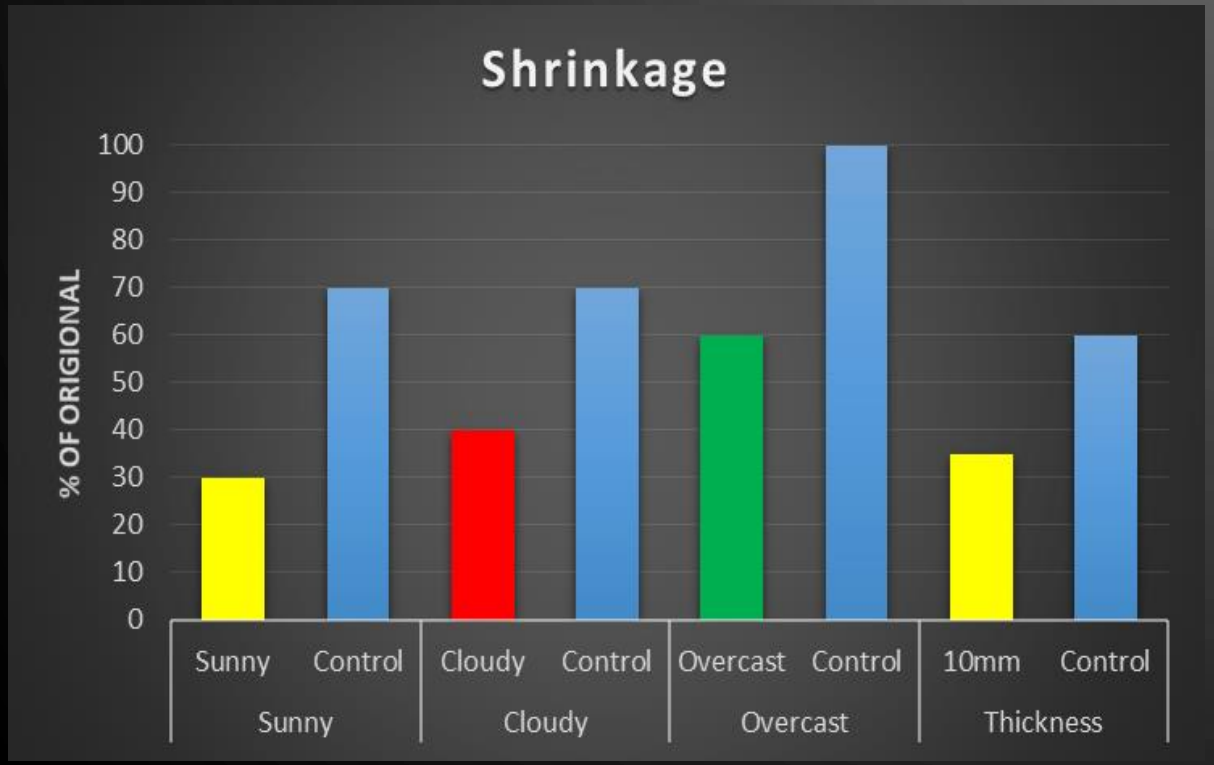


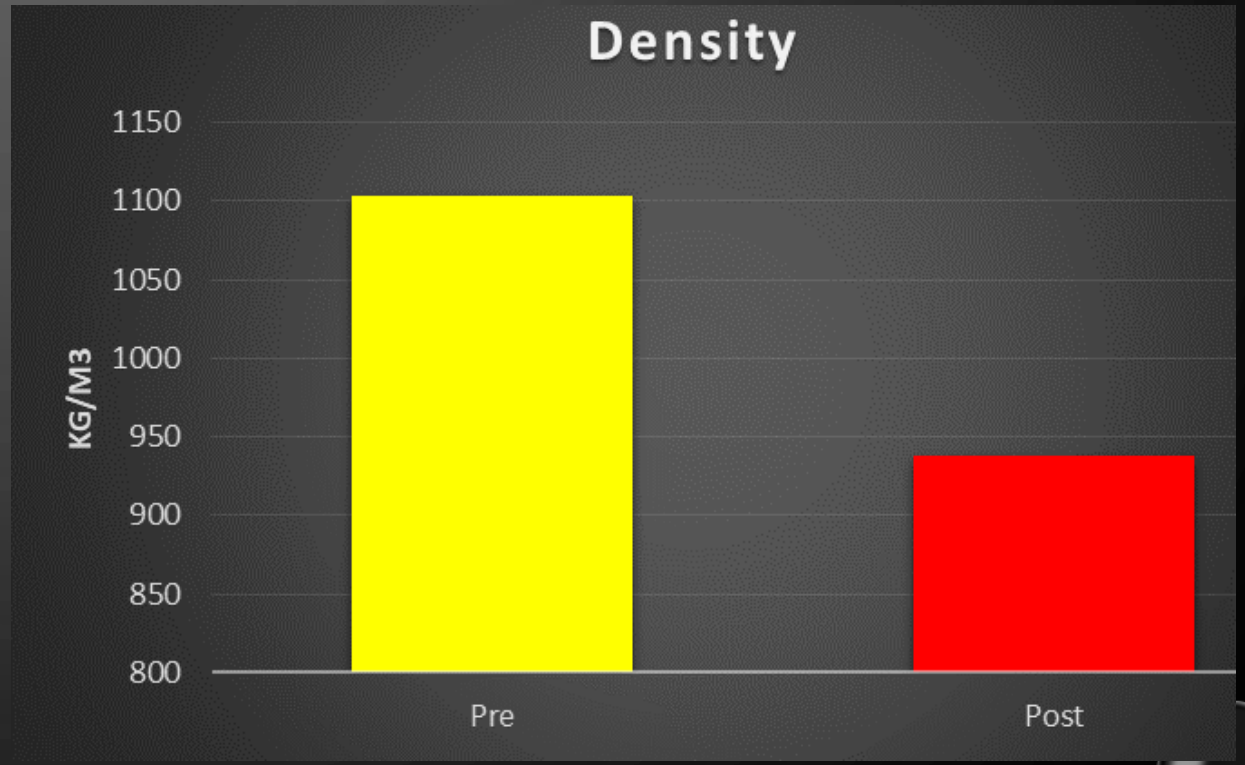
SIZE VARIATION

CORE TEMPERATURE (°C)	
5MM	42.10
10MM	35.81



QUANTITATIVE ANALYSIS





QUALITATIVE ANALYSIS

- ODOUR
- CRACKS
- CRUST

SUNNY

CONTROL

WET

DRY

CONCLUSION

- POTENTIAL
- DRYING RATES
- REDUCED EFFECTS OF VARYING WEATHER

FUTURE WORK

- NUTRIENT ANALYSIS
- VARIABLES:
  - PREHEATING
  - FLOW RATE
  - GEOMETRY
- MODELLING

ACKNOWLEDGEMENTS

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- POLLUTION RESEARCH GROUP LAB TECHNICIALS
- MECHANICAL WORKSHOP CHEMICAL ENGINEERING
- AUDIENCE

QUESTIONS