Integrative programming for simulation of packaging headspace and shelf life of fresh produce

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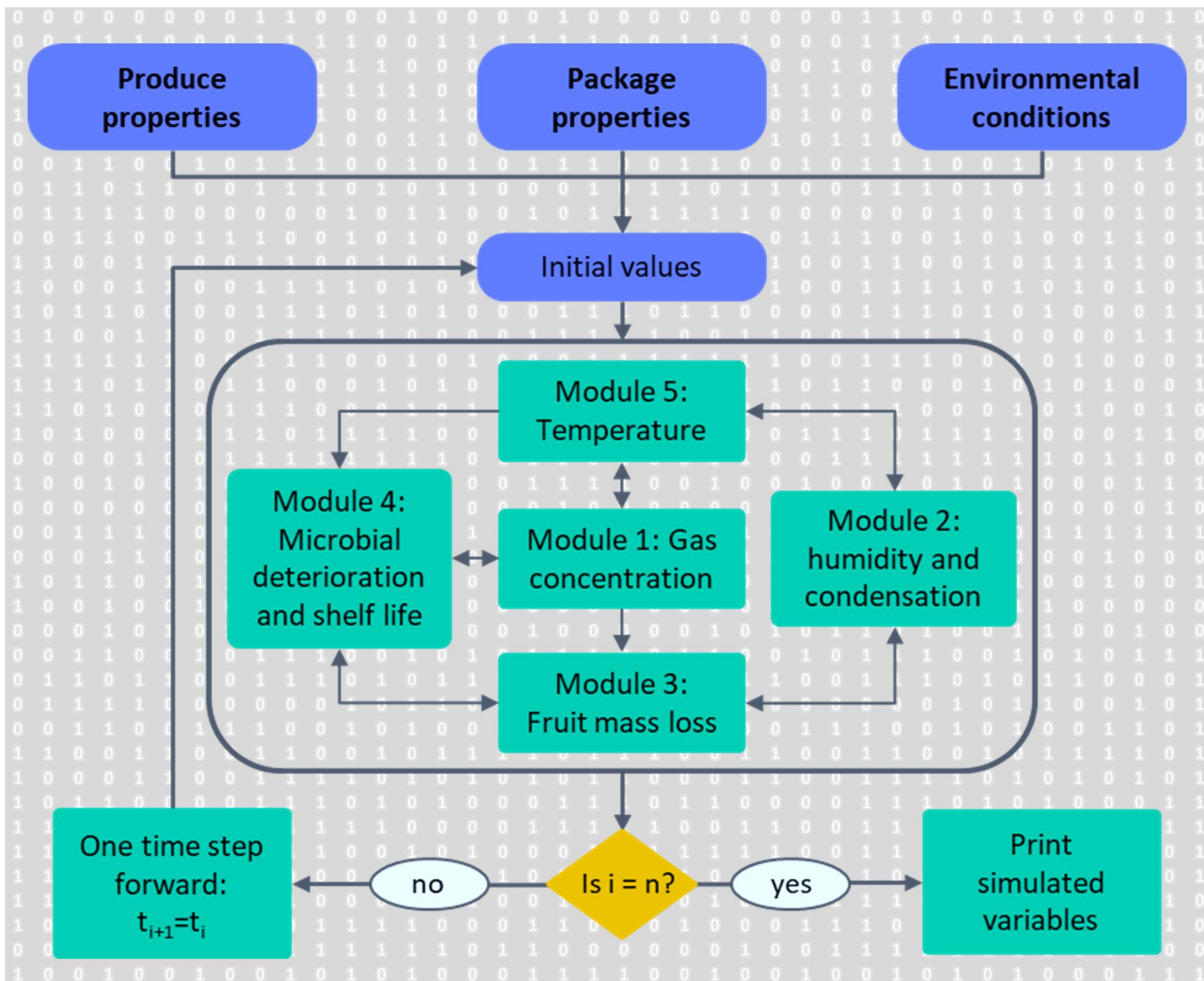
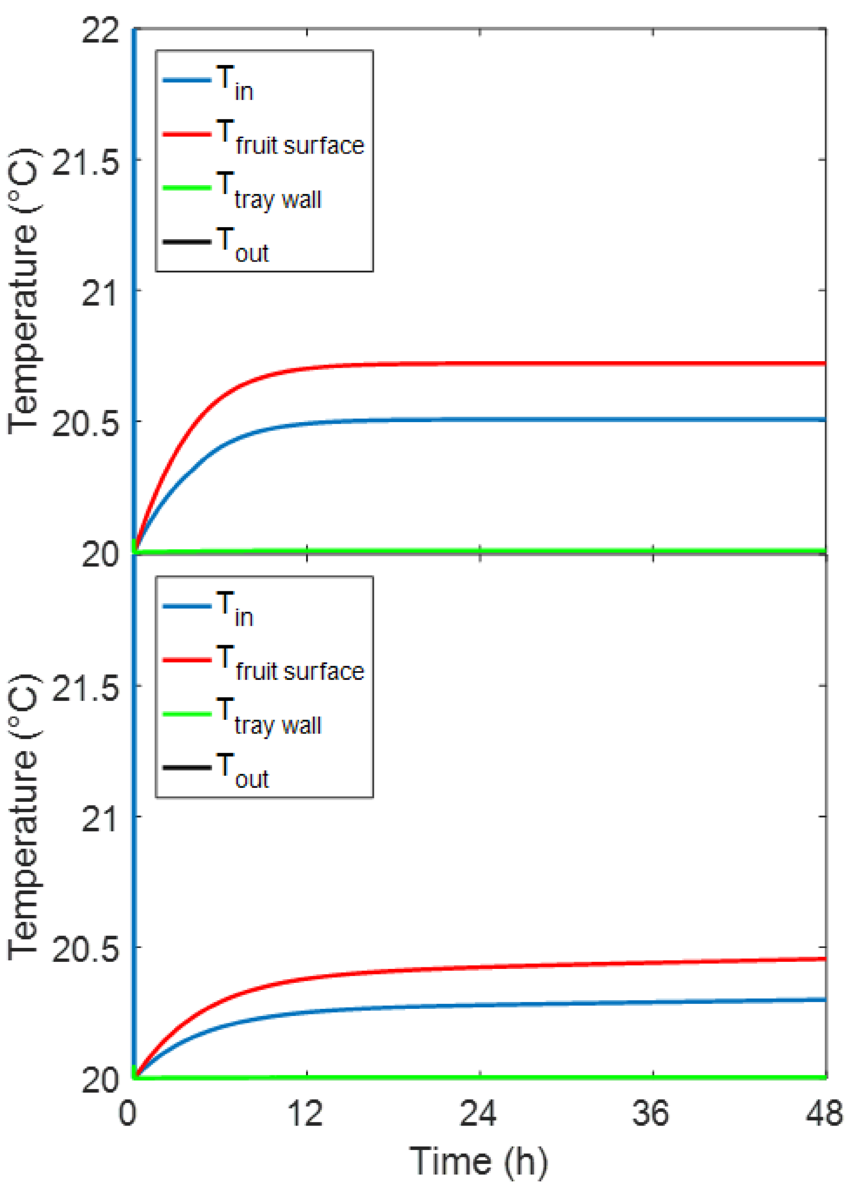
The real time measurements of storage conditions including temperature and relative humidity, enables estimating cumulative microbial deterioration and mass loss under dynamic storage conditions. Both estimated parameters were related to shelf life of fresh produce and validated with minimum product quality accepted by the consumer and satisfying the safety requirements of packaged and unpackaged fresh produce.

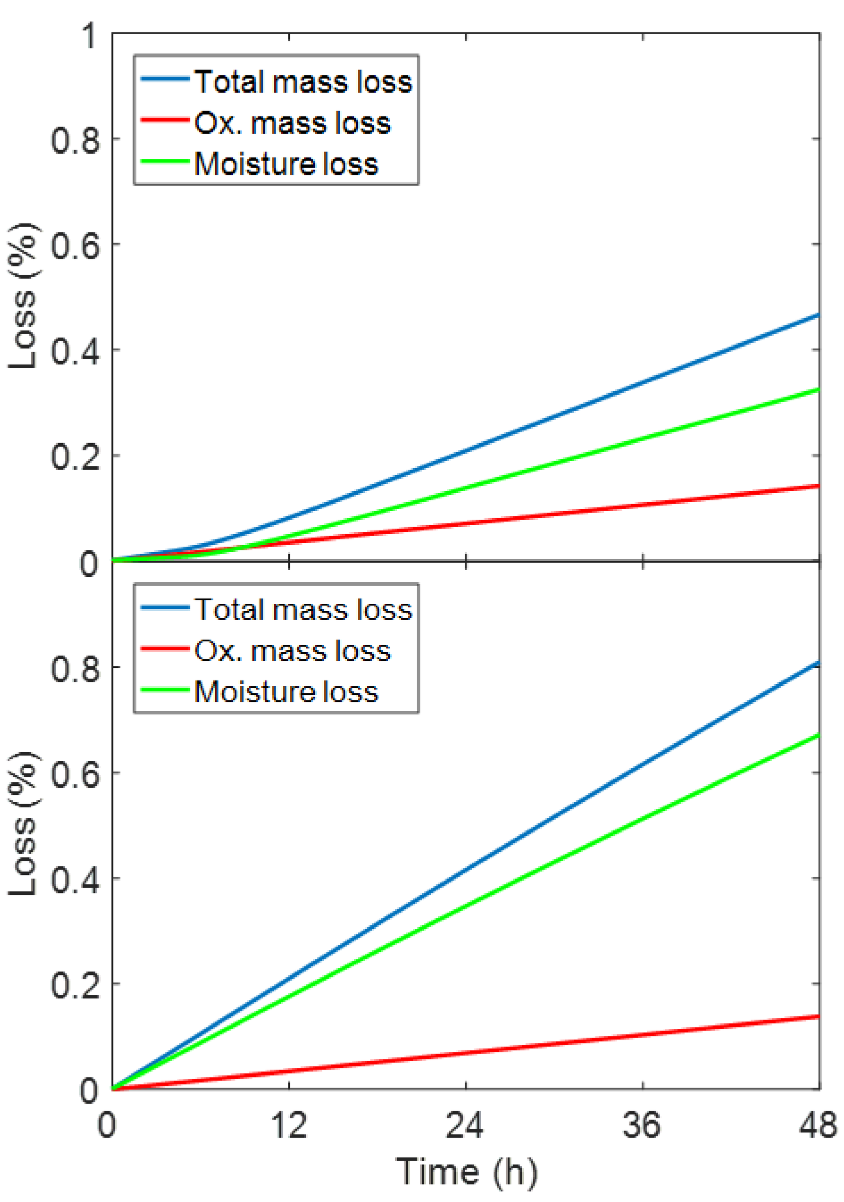
Capabilities of simulation program

- Flexible to input real supply chain conditions and properties of fresh produce and packaging material, thus, minimizing the costly and time consuming experimental procedures for selecting the optimum packaging material for fresh produce.
- designing the size and number of perforations to achieve equilibrium modified atmosphere alone or in combination with packaging material having higher water transmission rate or active moisture absorber.
- predicting the gas concentration, relative humidity and moisture evolution (permeation, absorption, condensation etc.)
- predicting the keeping quality and residual shelf life based on real-time supply chain data including temperature, relative humidity, gas concentration etc.

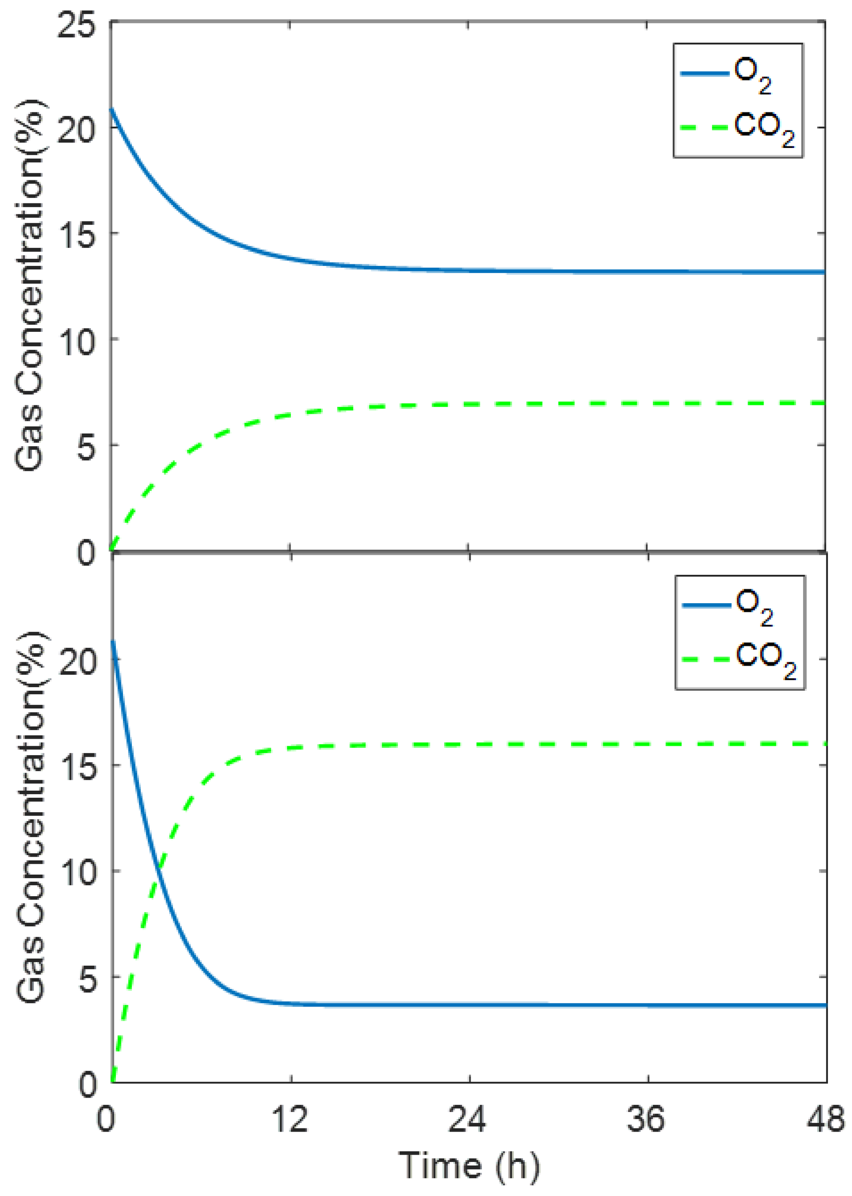




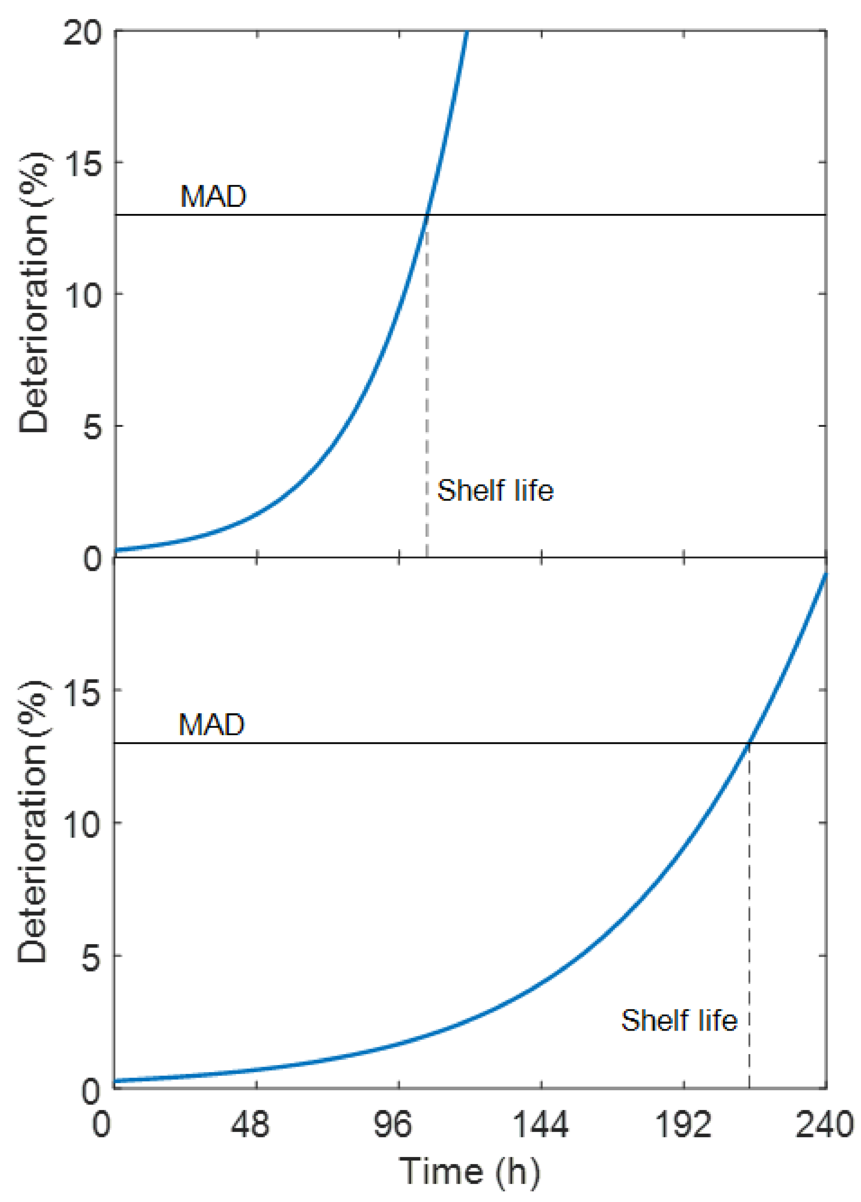
Temperature evolution for strawberry packaged in normal plastic tray (top) moisture absorber tray (bottom) under 20°C storage temperature



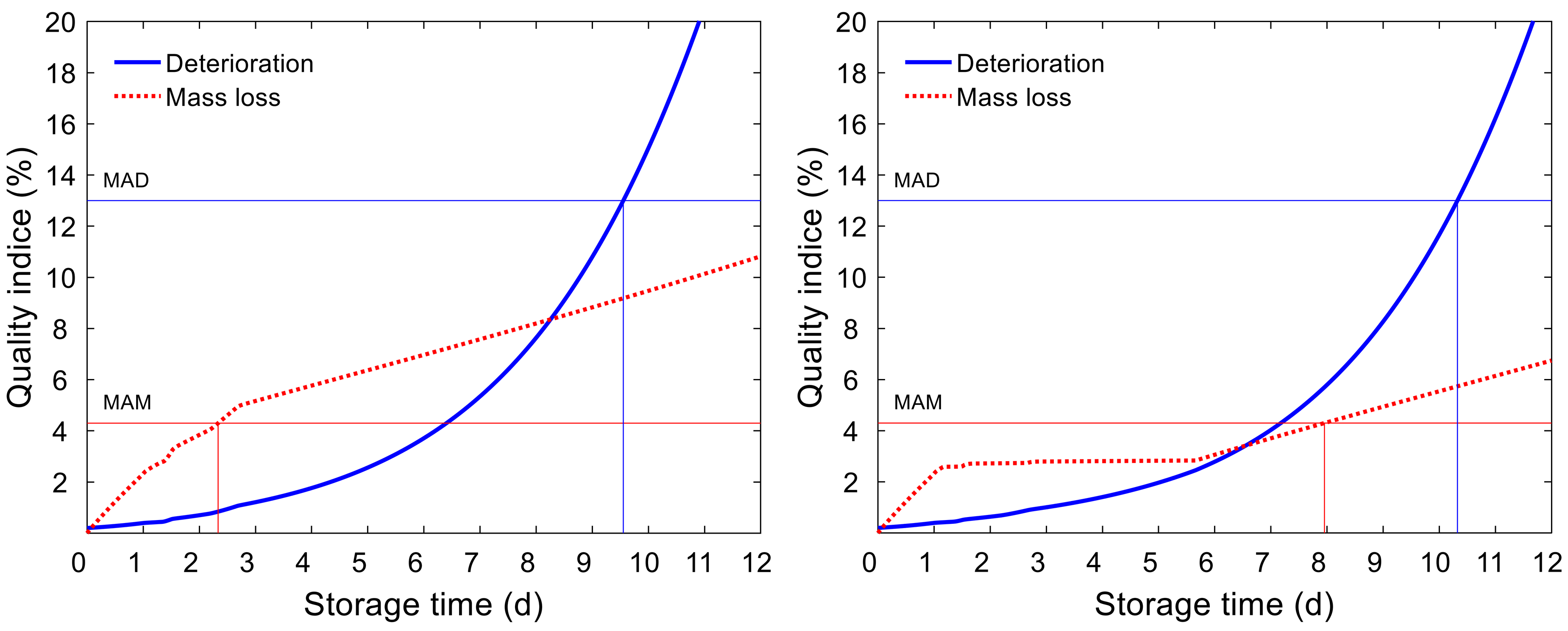
Percentage mass loss components for strawberry packaged in normal plastic tray (top) and moisture absorber tray (bottom) under 20°C storage temperature



Equilibrium gas composition of headspace for strawberry package with one perforation of 1 mm diameter in the film under 10°C (top) and 20°C (bottom) storage temperature



Microbial deterioration for strawberry package in (top) non-MAP (19.5 % O2 & 1.2 % CO2) and (bottom) MAP (3.5 % O2 & 16.1 % CO2) stored under 20°C



The effect of open tray packaging (left) and MAP conditions (right) on different quality indices including percentage mass loss and percentage microbial deterioration under realistic supply chain conditions.
MAM: maximum acceptable mass loss and MAD: maximum acceptable deterioration

References

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- Jalali et al.(2020): Shelf life prediction model for strawberry based on respiration and transpiration processes. Food Packaging and Shelf Life. https://doi.org/10.1016/j.fpsl.2020.100525
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