

## Executive summary

*Title of Project: Kinetic of thermal degradation of chlorophyll in green leafy vegetables and increasing the shelf life of the vegetables(SERB/MOFRI/037/2012)*

### Outcomes:

Preservation of green leafy vegetables could be achieved thermally by either pasteurization or sterilization. Sterilization though could provide effective preservation but for pastes and purees, it suffers from disadvantage like uneven heat distribution and loss of flavored and sensory characteristics of the vegetables. On the other hand pasteurization with the added effects of hurdles could provide effective thermal preservation techniques. In the present work thermal preservation of green leafy vegetable (Amaranth leaves) found in Chhattisgarh region is studied in terms of hurdle effects for kinetics of degradation and shelf life of the vegetables in presence of these hurdles. Different temperature, pH, salt and time combinations were tried to find out the suitable thermal methods for effectively sterilizing the purees, with least effect on color of these vegetables (since colour is important sensory characteristic that decided the acceptability of these vegetables for use in feed or food stocks). The color of green leafy vegetables pastes or purees is due to chlorophyll pigment (chlorophyll a and b). Temperature was varied from 70 to 90 °C; pH was varied from 5.6, 6.6 and 7.6 (acidic, neutral and basic) and salt concentration was varied from 10-100 ppm in enforcing hurdles to the thermal treatment. The analysis of the degradation was done using spectrophotometric method. Kinetics of thermal degradation was studied by noting the change in concentration of chlorophyll with time. The degradation of chlorophyll pigment was found to be first order and first order rate constant ( $k$ ) was evaluated at different temperatures and pH.  $k$  was found to decrease with increase in temperature and hence implying that higher degradation was observed at higher temperature. Thus this brings out that at higher temperature the puree should be processed for lower times. Activation energy ( $E$ ) was evaluated using Arrhenius method. Increase in pH was found to lower the  $k$  values and hence thermal treatment is better at high pH values. However, at higher pH there are some tart in the puree as found by tasting the puree. In addition five different salts were tried to see the effect of different zinc salt (zinc, zinc oxide, zinc sulfate, zinc magnesium phosphate and zinc chloride) on the shelf life in terms of color of these vegetables. Shelf life was studied in terms of days for varying salt ppm on the zinc pheophytin content in the leafy vegetables with and without pasteurization. These informations are essential in the design of suitable thermal processing equipment for preservation of green leafy vegetables pastes/purees.

### Future direction:

There is a challenge in providing uniform heat treatment as this could have caused over heating or under heating of viscous purees. This could be studied computationally. In addition, in continuous flow systems, the rheology of the purees is important in terms of flow behavior and heat penetration. Further other parameters such as texture and taste is needed to be studied along with color to confirm the suitability of these purees for customer use. These works are targeted in the work going on.