

## Concentrated Whey Protein Drink with Orange Flavor: Protein Modification and Formulation

**Authors :** Shahram Naghizadeh Raeisi, Ali Alghooneh

**Abstract :** The application of whey protein in drink industry to enhance the nutritional value of the products is important. Furthermore, the gelification of protein during thermal treatment and shelf life makes some limitations in its application. So, the main goal of this research is manufacturing of high concentrate whey protein orange drink with appropriate shelf life. In this way, whey protein was 5 to 30% hydrolyzed ( in 5 percent intervals at six stages), then thermal stability of samples with 10% concentration of protein was tested in acidic condition (T= 90 °C, pH=4.2, 5 minutes ) and neutral condition (T=120° C, pH:6.7, 20 minutes.) Furthermore, to study the shelf life of heat treated samples in 4 months at 4 and 24 °C, the time sweep rheological test were done. At neutral conditions, 5 to 20% hydrolyzed sample showed gelling during thermal treatment, whereas at acidic condition, was happened only in 5 to 10 percent hydrolyzed samples. This phenomenon could be related to the difference in hydrodynamic radius and zeta potential of samples with different level of hydrolyzation at acidic and neutral conditions. To study the gelification of heat resistant protein solutions during shelf life, for 4 months with 7 days intervals, the time sweep analysis were performed. Cross over was observed for all heat resistant neutral samples at both storage temperature, while in heat resistant acidic samples with degree of hydrolysis, 25 and 30 percentage at 4 and 20 °C, it was not seen. It could be concluded that the former sample was stable during heat treatment and 4 months storage, which made them a good choice for manufacturing high protein drinks. The Scheffe polynomial model and numerical optimization were employed for modeling and high protein orange drink formula optimization. Scheffe model significantly predicted the overall acceptance index (Pvalue<0.05) of sensorial analysis. The coefficient of determination (R<sup>2</sup>) of 0.94, the adjusted coefficient of determination (R<sup>2</sup>Adj) of 0.90, insignificance of the lack-of-fit test and F value of 64.21 showed the accuracy of the model. Moreover, the coefficient of variable (C.V) was 6.8% which suggested the replicability of the experimental data. The desirability function had been achieved to be 0.89, which indicates the high accuracy of optimization. The optimum formulation was found as following: Modified whey protein solution (65.30%), natural orange juice (33.50%), stevia sweetener (0.05%), orange peel oil (0.15%) and citric acid (1 %), respectively. Its worth mentioning that this study made an appropriate model for application of whey protein in drink industry without bitter flavor and gelification during heat treatment and shelf life.

**Keywords :** croos over, orange beverage, protein modification, optimization

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