ABSTRACT

The aim of the present study was to explore novel, natural dietary fibre sources, evaluate their functional properties, dietary fibre profile, isolation of major fibre components and incorporation of these natural fibres in processed foods. In the present study, routinely used vegetables/legumes/spices such as ashgourd, bottlegourd, radish, pea peels, cardamom peels etc, were explored. Screening of the dietary fibre source was done on the basis of the dietary fibre profile (soluble, insoluble and total dietary fibre), flavour, colour, wastage quantum and convenience for incorporating them in different edible products. Thus ashgourd, radish, pea peels and cardamom peels were the promising selected sources for further study. The fibres from the respective sources were isolated wherein the drying kinetics revealed that the rate of dehydration could be positively correlated to the soluble dietary fibre fraction. These fibres were subjected to granulometry (18 to 150 mesh sieves), wherein 60 mesh particles recorded highest yield, followed by 30 and 100 mesh. The exact particle size of fibres from three different mesh i.e. 30, 60 and 100, were analysed using Image Analyzer, wherein the diameters ranged from 280-410 μm followed by 140-230 μm and 40-110 μm, respectively. These fibre particles were also subjected to Scanning Electron Microscopy (SEM), to study the microstructures of fibre particles, before and after hydration. The image as well as microstructural analysis of particles showed distinctive properties. These natural fibres were studied for dietary fibre profile, wherein ashgourd fibre exhibited maximum soluble fibre fraction (22.76%), whereas cardamom peel fibre exhibited maximum insoluble dietary fibre fraction (83.30%). The functional properties such as water holding capacity, water binding capacity, swelling capacity, oil binding capacity, cation exchange capacity and particle density, were also studied at three different mesh sizes i.e. 30, 60 and 100. The coarser fibre particle i.e. 30 and 60 mesh, showed better dietary fibre profile and functional properties as compared to 100 mesh particles. The free radical scavenging activity, reducing power and total phenol content of these fibres were also estimated. Amongst the fibres, cardamom peel fibre showed fastest radical scavenging activity (92.25%) and highest total phenol content (78.1mg/10mg). In vitro studies on the role of
these natural dietary fibres in physiological actions with reference to pH and contact time in digestive tract (oral, stomach and duodenum), glucose diffusion assay and glucose adsorption capacity were also studied, for different particle sizes. The major fibre components i.e. neutral detergent fibre, acid detergent fibre, cellulose, hemicellulose, pectin and lignin were estimated in the fibres. Further, the major components (cellulose, hemicellulose and pectin) of the most promising fibre i.e. ashgourd fibre, were isolated and studied for their major functional properties, so as to understand the role of each isolate individually. The pectin isolate was further characterized by determination of molecular weight using gel permeation chromatography (GPC). The molecular weight of ashgourd fibre pectin was 52.84 kDa. The application of these fibres was attempted by the incorporation of these fibres into processed foods. The effect of these fibres on the processing such as pasting and thermal treatments were also investigated, using rapid-visco-amylograph and differential scanning calorimeter (DSC), so that it provides a better insight for the development of quality products. Six fibre rich products i.e. pea peel fibre based sweet cookies, ashgourd fibre based savoury cookies, cardamom peel fibre based kheer, radish fibre based savoury vermicelli, ashgourd fibre based roasted snack and radish fibre based fried snack, were developed using combination and statistical methods (RSM). The proximate composition and dietary fibre profile of these products were compared with the control samples. The effect of different processing conditions on the dietary fibre profile was also observed. The quality parameters of these fibre rich products proved that these products were quite stable and very well accepted till 6-8 months, especially in tri laminated PFP pouches, at room temperature and provided 15-30% additional fibre in the diet.