Abstract

In the present study, physical and biochemical characterization, and antioxidant activity evaluation of *Aloe vera* L. (Family: Xanthorrhoeaceae) gel was carried out from different growth periods of plants. Freeze-dried *Aloe vera* gel was obtained from 2, 3 and 4-year-old plants during summer and assigned as S2, S3 and S4; whereas freeze-dried gel prepared during rainy and winter season from 3-year-old *A. vera* were described as R3 and W3, respectively. Physical properties of aloe gel (AG) were studied following the evaluation of different functional and thermal properties. Microstructure of freeze-dried gel was analyzed at pre- and post-rehydration stages by SEM. Biochemical characterization was directed towards the estimation of different primary and secondary metabolites, detection of functional groups and assessment of the degree of acetylation; various mineral contents present in AG have also been estimated. The evaluation of antioxidant activity of freeze-dried AG followed by the fractionation and characterization of the antioxidant rich fraction has also been carried out. Physical and biochemical variation in AG was evident at different periods of growth. S3 was identified as the potential gel with optimum level of physical and biochemical properties, and antioxidant potential as well. Maximum thermal stability with a T_g of 135.00 °C was found in S3. Smoothness and uniformity in microstructure of S3 is mainly due to better cross-linking of polysaccharides. High degree of acetylation in S3 is concomitant with the notion of well organized gel matrix formation with adequate synthesis of polysaccharides. Presence of selenium, an anti-oxidative element, has been detected in AG, which is the first report of its finding. Quantitative HPLC analysis showed that aloin content in freeze-dried gel ranged from 1.48 ± 0.26 to 3.51 ± 0.12 µg/g. S3 exhibited 13.52 ± 0.53% of DPPH radical scavenging activity at 10 mg/ml of concentration. Antioxidant activity of gel was also corroborated by the reducing power, transition metal ion chelating, superoxide radical and hydroxyl radical scavenging assays. Aloin content was found to be high in the bioactive fraction of gel with high antioxidant and UV absorbing activity. An intrinsic structure-function relation with reference to the physico-chemical properties and functional group distribution was noticed by PCA and Pearson correlation study, which can be influenced by the plant growth periods.

Key words: Aloe vera L. gel, Physical properties, Mineral analysis, Biochemical characterization, Antioxidant assay, Principal component analysis.