The Low-Cost, Simple "Green Chemistry" Method of Carotenoids Obtained via Formation of Zn-Al LDH–Carotenoid Nanocomposite in vitro in Vegetable or Fresh Fruit

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Carotenoids are biologically active substances, widely used as vitamins, food dyes and pigments. Main disadvantages of industrial production of carotenoids include use of organic solvents (flammability, solvent residues in the product, high cost etc). The current research project aim was to develop low-cost “green chemistry” method of carotenoids extraction via formation of «Zn-Al LDH–carotenoid» nanocomposite in vitro from the vegetable & fruit fresh juices. Green, white, yellow and orange tomatoes, oranges and pumpkin have been selected as carotenoids sources. Fresh juices were obtained from them by blending and filtering. “Zn-Al LDH – carotenoid” nanocomposite was formed after adding Zn and Al salts directly to fresh juice and increasing pH to 9 by alkali (under heating and stirring) with subsequent filtration. Grinding composite samples were characterized by PXRD, DTG, DSC, SEM, TEM, EDX, IR, LC-MS. By visual observation of composite formation and rapid solution clarification was observed. It was shown that obtained composite has high filterability and great plasticity after drying. LDH in the composite was detected by PXRD and EDX, nanosize particles were shown by TEM. Carotenoids inclusion in composite was observed by IR and LC-MS, its high thermal stability – by TG, DSC. Self-abrasion phenomena was shown for the first time during composite grinding followed by mechanical separation of carotenoids from LDH. Conclusion: low-cost, solvent-free, “green chemistry” method of carotenoids extraction via formation of «Zn-Al LDH – carotenoid» nanocomposite in vitro from fresh juices was developed. New simple possibility for mechanical separation of carotenoids by composite grinding with self-abrasion was detected.