

Title           Residue from star fruit as valuable source for functional food ingredients and antioxidant nutraceuticals  
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### Abstract

Our previous study has indicated that star fruit (*Averrhoa carambola* L.) is a good source of natural antioxidants and that polyphenolics are its major antioxidants. In this study, the residue of star fruit, which is normally discarded during juice drink processing, was found to contain much higher antioxidant activity than the extracted juice using several methods for assessing antioxidant activity. Under optimized extraction conditions, the residue accounted for around 70% of total antioxidant activity (TAA) and total polyphenolic contents, however only contributed 15% of the weight of whole fruit. Freeze-dried residue powder, which accounted for around 5% of total weight, had total polyphenolic content of  $33.2 \pm 3.6$  mg gallic acid equivalent (GAE)/g sample and total antioxidant activity of  $3490 \pm 310$  and  $3412 \pm 290$  mg L-ascorbic acid equivalent antioxidant capacity (AEAC) or  $5270 \pm 468$  and  $5152 \pm 706$  mg trolox equivalent antioxidant capacity (TEAC) per 100 g sample obtained by 2,2'-azino-bis-(3-ethylbenzthiazoline-6-sulfonic acid) free radical (ABTS<sup>+</sup>•) and 1,1-diphenyl-2-picryl-hydrazyl (DPPH•) scavenging assays, respectively. It was also found to have  $510.3 \pm 68.1$  mol ferric reducing/antioxidant power (FRAP) per gram sample. The residue extract also shows strong antioxidant activity in delaying oxidative rancidity of soya bean oil at 110 °C. Antioxidant activity and polyphenolic profile of residue extracts were compared with extracts of standardized pyconogenol. High performance liquid chromatography coupled with mass spectrometry (HPLC/MS) shows that major proanthocyanidins in star fruit were different from their isomers in pyconogenol. The high content of phenolics and strong antioxidant activity of residue extracts indicate that residue powder may impart health benefits when used in functional food products and that residue extracts should also be regarded as potential nutraceutical resources in future.