Grape pomace, an industrial by-product from the wine process, has been recognized as an important and inexpensive source of polyphenols. The seeds constitute a considerable proportion of the grape pomace, amounting to 38-52% on a dry matter basis. The objective of this study was to evaluate the profile of galloylated and non-galloylated flavan-3-ol compounds and the presence of enantiomers of catechin and epicatechin in seeds of pomace from the vinification of grape varieties widely produced in Brazil with a view to their exploitation as a potential source of natural antioxidants. Chiral capillary electrophoretic analysis showed that the fermentation process of winemaking do not gave rise to (−)-catechin and (+)-epicatechin enantiomers. Only (+)-catechin and (−)-epicatechin were detected. High-performance liquid chromatography coupled with a diode array detector and an ion trap mass spectrometer (HPLC-DAD-MS) showed the presence of several different galloylated and non-galloylated flavan-3-ol compounds and the presence of condensed products of catechin with acetaldehyde, presumably assigned to (epi)catechin-ethyl dimers and trimers. Gallic acid, catechin, epicatechin and procyanidins B1 and B2 were identified with authentic standards; all other compounds were tentatively identified by combining UV spectra and MS fragmentation data and by comparison with data from the literature. Oligomers with up to four monomer units were detected. Most of the detected compounds were common for all the varieties analyzed. A total of 70 compounds were tentatively identified. The data suggested that the seeds of grape pomace, especially of Pinot Noir variety may be exploited as a source of polyphenols.