

**Figure 1.** System boundaries of the examined BioSA production process at full-scale.

**Figure 2.** Plant flow chart of the apple pomace based BioSA production process.

**Figure 3.** Distribution of contributions to the environmental profile per sections (Sections 1, 2 and 3) and ancillary activities involved within the BioSA production plant from apple pomace. Production of enzymes has been excluded from the results. Acronyms: GWP - global warming potential, AP - acidification potential, EP- eutrophication potential, ODP - ozone layer depletion potential, POP - photochemical oxidation potential and CED – cumulative energy demand.

**Figure 4.** Distribution of contributions per section per operations involved to identify hotspots. Production of enzymes has been excluded from the results. a) Section 1; b) Section 2; c) Section 3; d) Ancillary activities. Acronyms: GWP - global warming potential, AP - acidification potential, EP- eutrophication potential, ODP - ozone layer depletion potential, POP - photochemical oxidation potential and CED – cumulative energy demand.

**Figure 5.** Comparative profiles between alternative scenarios. a) Plant A1 – Base plant excluding enzymes production; Plant B – Alternative plant with modifications in the purification section; b) Plant A2 – Base plant including enzymes production; Plant C – Alternative plant with modifications in the fermentation section and consequent changes; Acronyms: GWP - global warming potential, AP - acidification potential, EP- eutrophication potential, ODP - ozone layer depletion potential, POP - photochemical oxidation potential and CED – cumulative energy demand.

**Figure 6.** Comparison of the LCA impact categories for BioSA production with different recycling rates for solvents (TOA and 1-octanol). Acronyms: GWP - global warming potential, AP - acidification potential, EP- eutrophication potential, ODP - ozone layer depletion potential, POP - photochemical oxidation potential and CED – cumulative energy demand.

**Figure 7.** Comparison in kgCO<sub>2</sub>eq per kg of succinic acid among the scenario under assessment (BioSA-A), the scenarios based on sorghum, corn and sugarcane (BioSA-B, BioSA-C and BioSA-D, respectively), the alternative scenario modifying the purification unit (BioSA-E) and the fossil scenario (FossilSA).

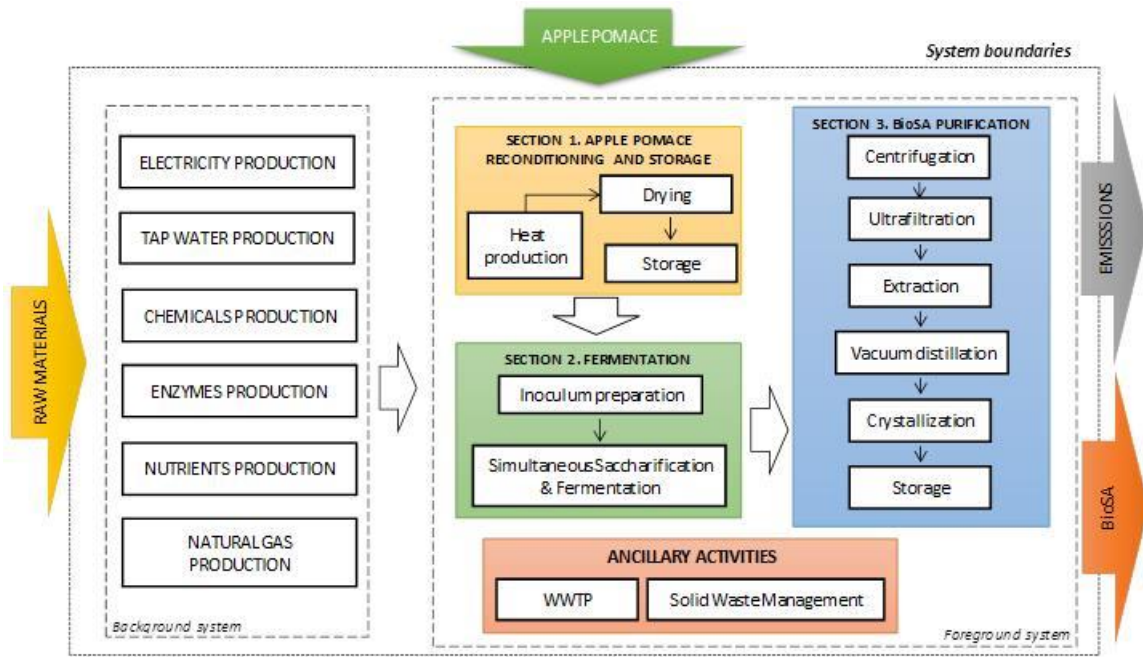
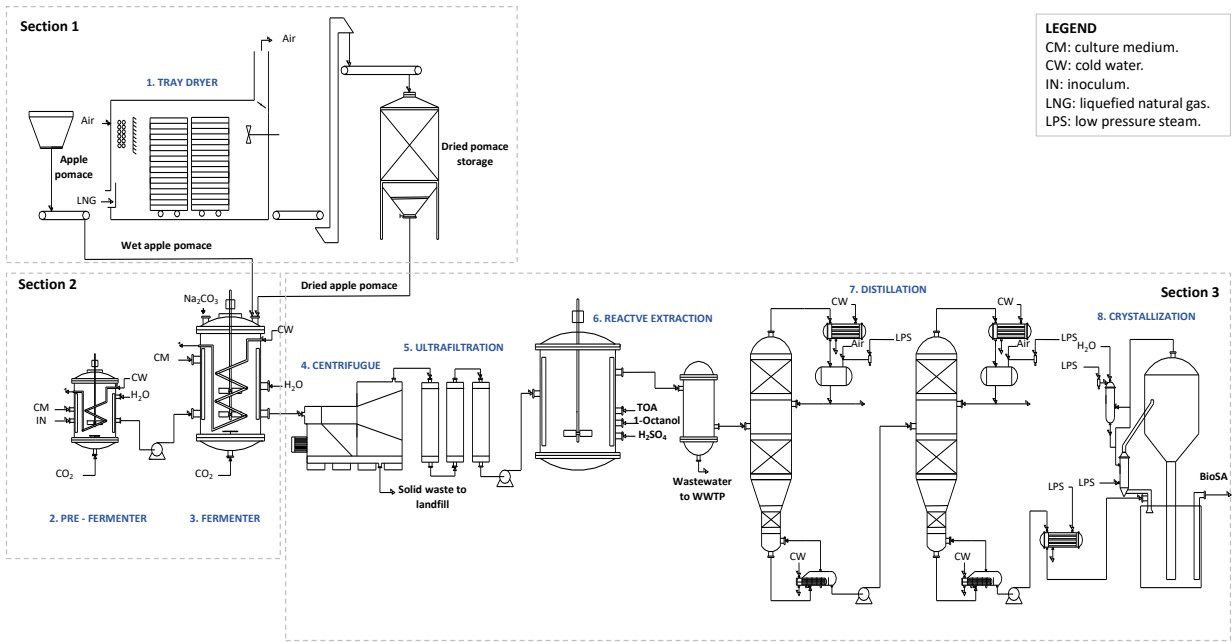
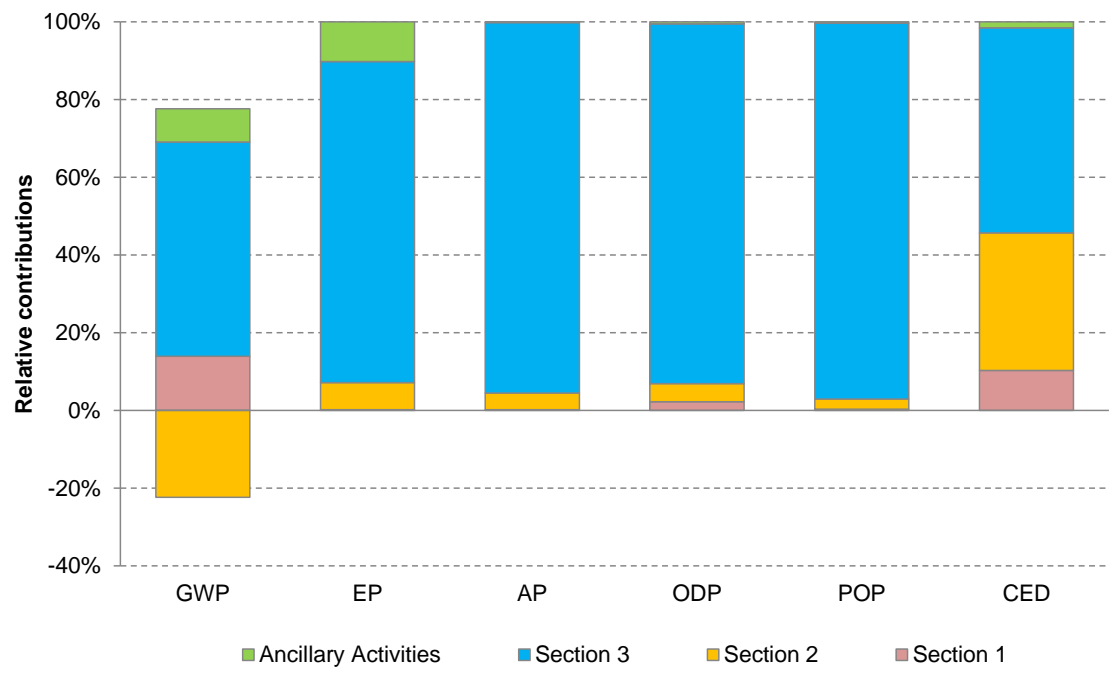


Figure 1



**Figure 2**



**Figure 3**

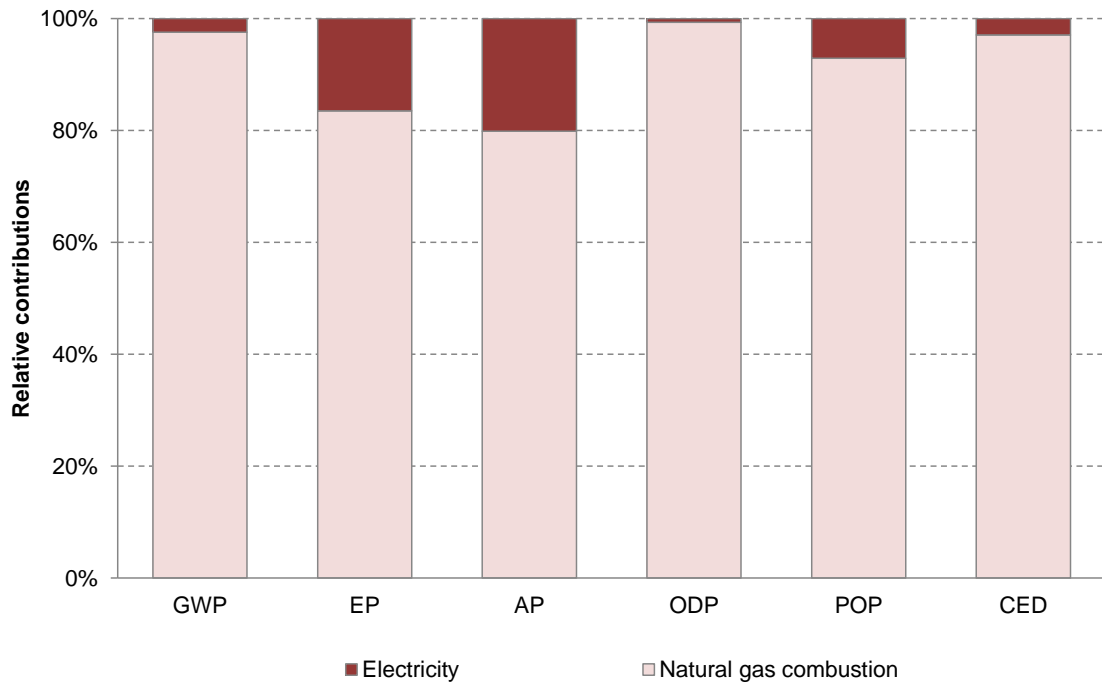


Figure 4a

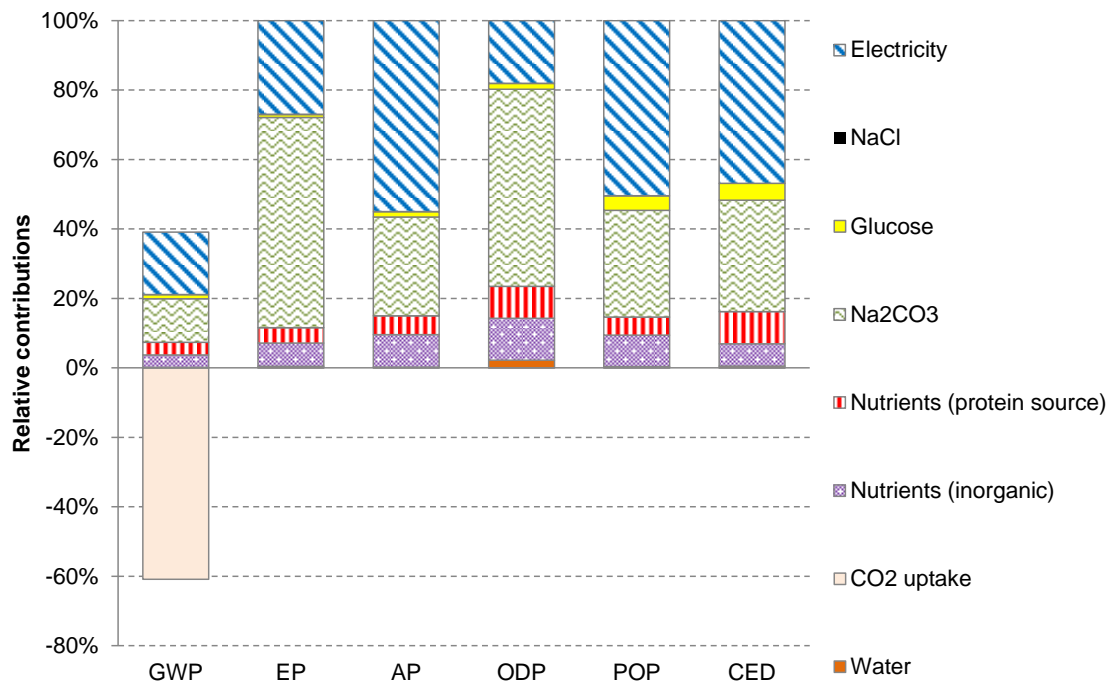
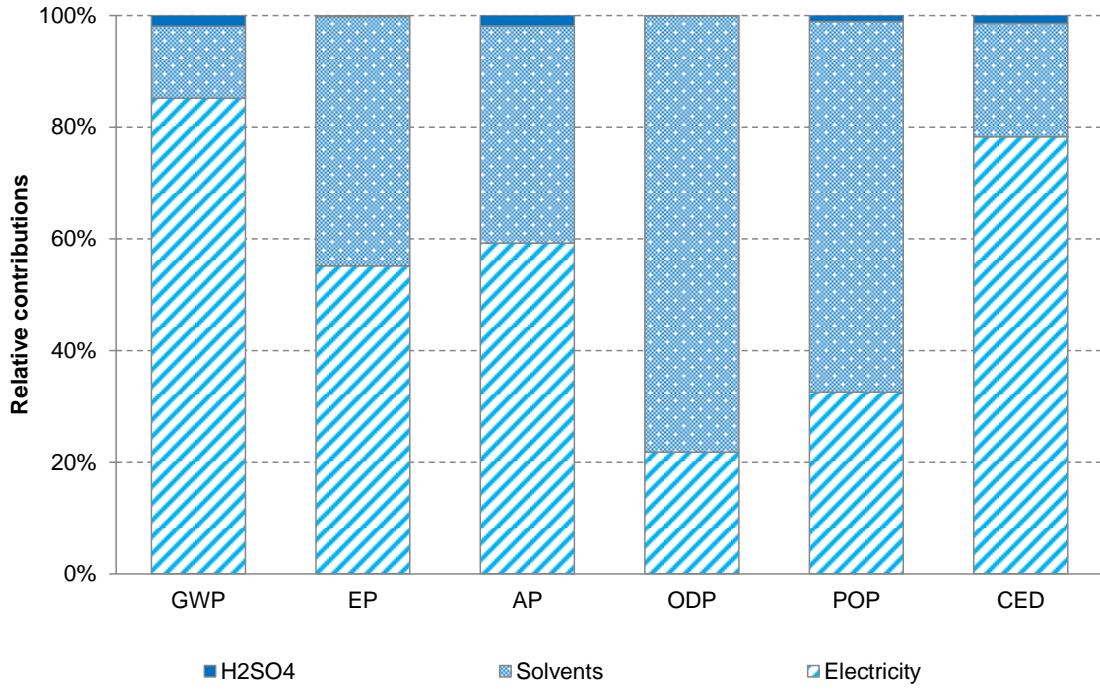
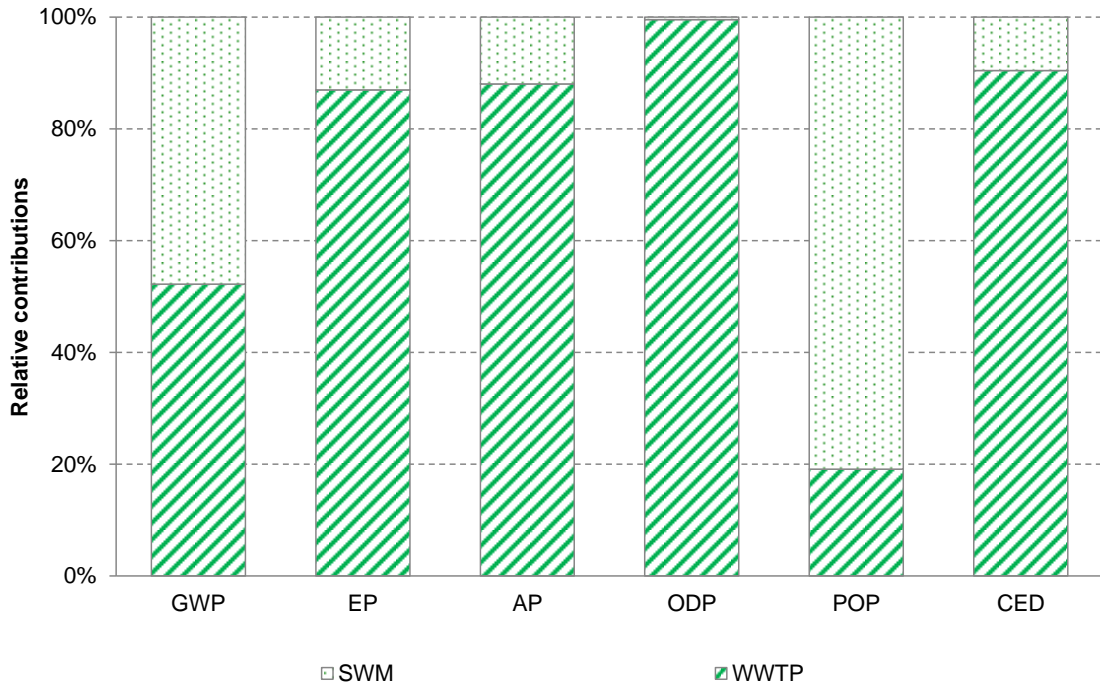


Figure 4b



**Figure 4c**



**Figure 4d**

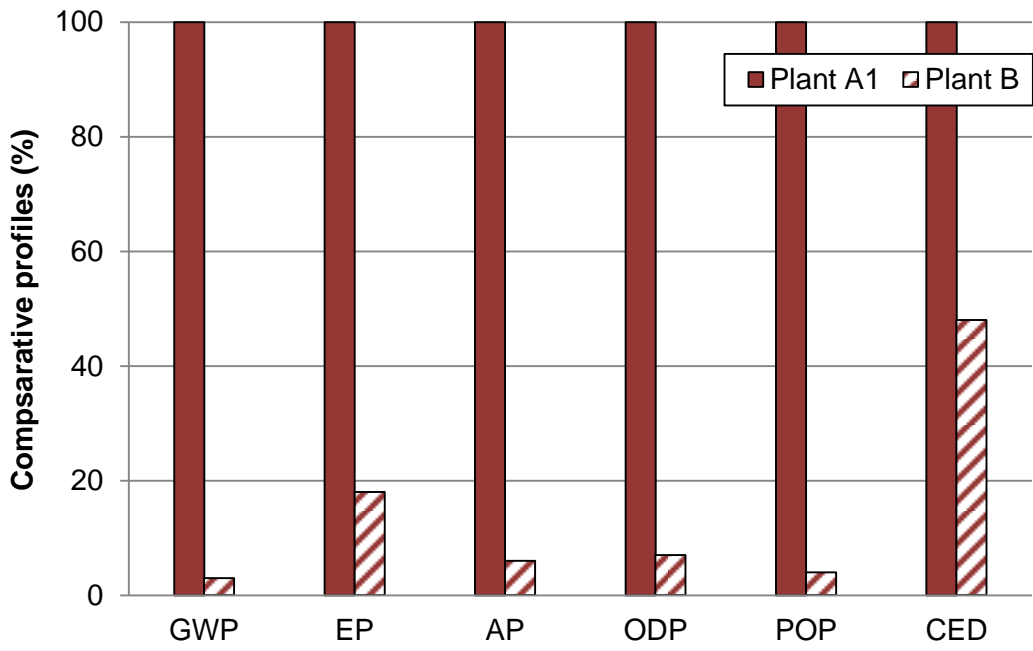


Figure 5a

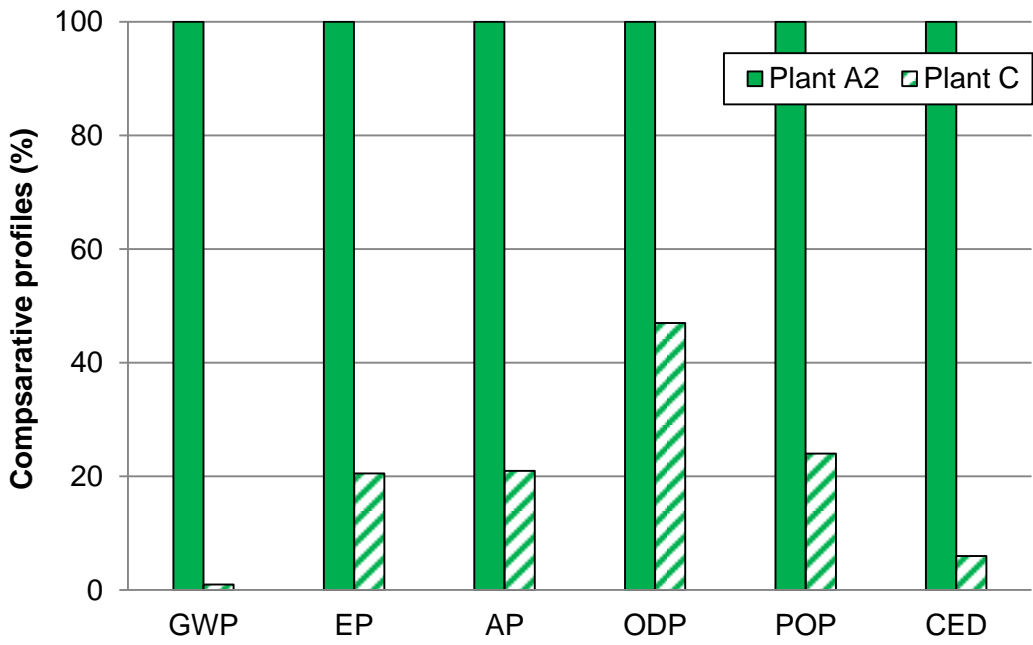
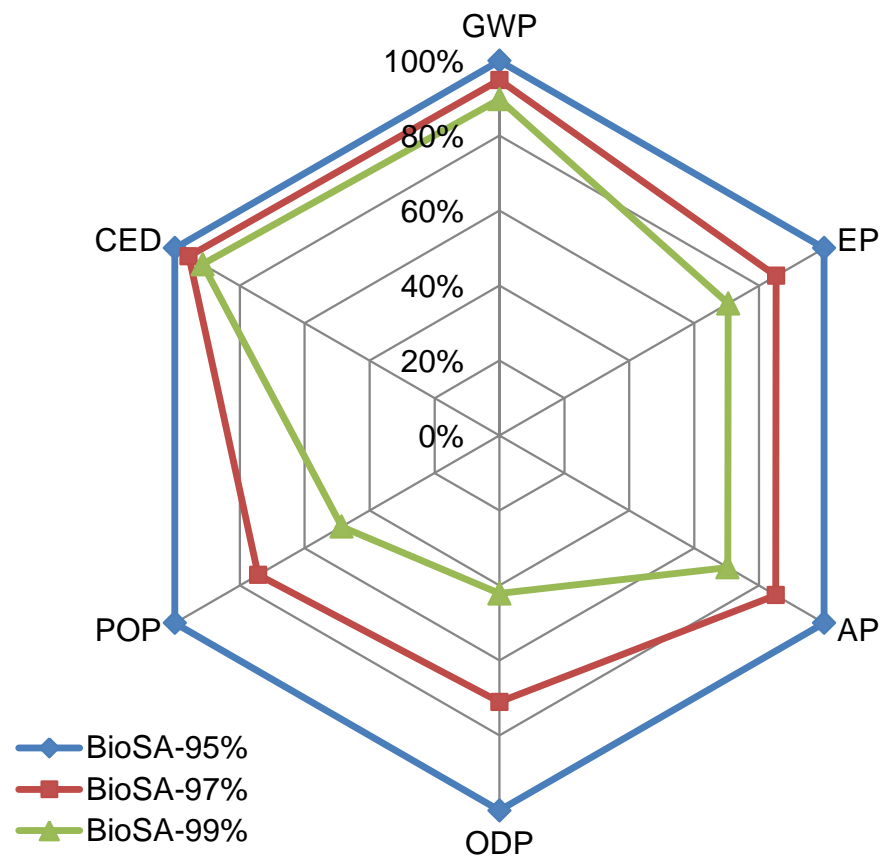
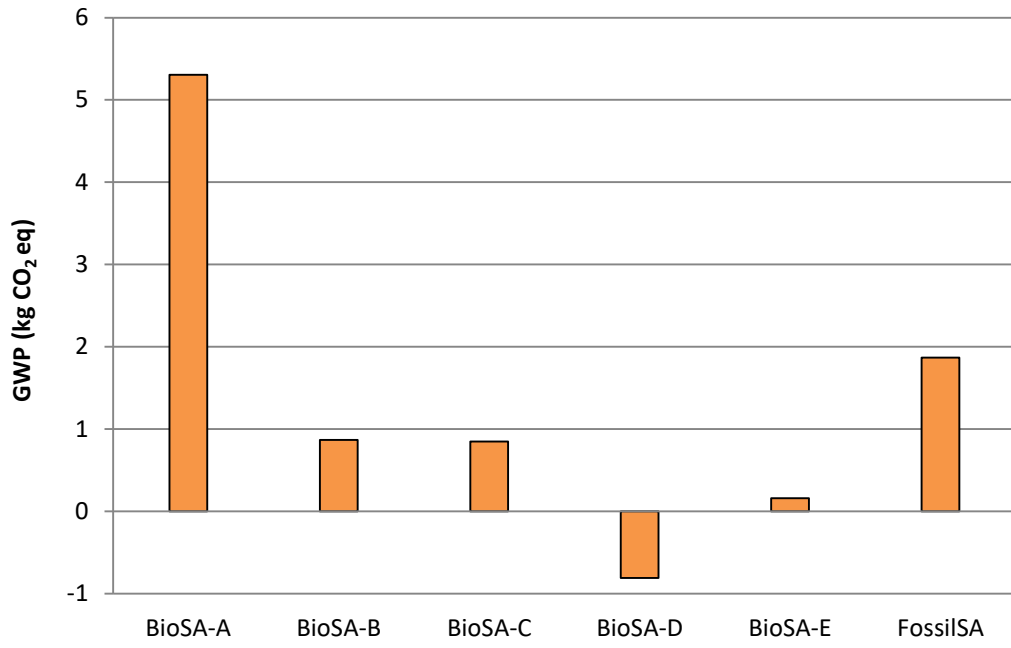


Figure 5b



**Figure 6**



**Figure 7**