

## Chemical properties of pine cones

Ömer Ümit Yalçın<sup>1,\*</sup>, Halil Turgut Şahin<sup>1</sup>

<sup>1</sup> Suleyman Demirel University, Faculty of Forestry, 32260, Isparta, Turkey

\* Corresponding author: omeryalcin@sdu.edu.tr

**Abstract:** The cone is an organ of conifers that contains the reproductive structures. There is growing interest products from natural materials in worldwide. However, the chemical compounds from cones are great interest because of its residue products. A number of studies on conifer cones have available in literature. Majority of these studies are on morphological, chemical and materials properties of cones. All these findings have contribute to better utilization of materials from conifer cones as new medicinal plant products. However, it was consistently reported that the chemical constituents of cones changed depend on geographical, seasonal, genotypic and environmental situations. It was reported that conifer cones have similar chemical constituents like wood but in various proportion. They markedly contain rich of phenolic compounds and some extractives. They consists cellulose, lignin, and hemicelluloses as major constituents. They have also some condense tannins, resin acids, stilbenes, flavonoids, etc. Many of researchers have already reported that these extracts, which have various proportions in different species may offer some advantages in terms of utilization from waste materials and may show exceptional medicine properties.

A number of different approaches have also applied with cone to find alternative and economical. It has also used for manufacturing various kinds of composite and paper material as substituent of wood. It has already tried to use for particleboard, fiberboard and plastic composite process aiming to without lowering properties. The results reported in that area is promising. It has also utilized for purifying of waters as bioabsorbent or scavengers for heavy metals from waste streams. It has also found to be useful for producing cellulose with its intrinsic viscosity and molecular weight. However, it has already well explained that some extracts from cones show antioxidant, antifungal, antimicrobial properties and may cure some disorders of humans. The utilization of these constituents from forest residue material (i.e. conifer cone) may offer many possible applications as raw material.

**Keywords:** Pine cone, Utilization, Cellulose, Chemical properties