

Abstract

Wood is a natural and organic material which has been used in widespread cultural and historical relics, due to its simple accessibility. Many wooden relics were located in open air spaces. Weathering is an important degradation phenomenon on the surface of these relics. Photochemical decay has a main role in the weathering of wood. Regarding to material composition features and conservation ethics, different treatments for conservation purposes were studied. This research was accomplished by literature reviews, in situ assessments and laboratory evaluation with attendant quantitative analysis in four phases. In the first phase, after preliminary studies, characteristics and weathering degradation were explained in historic samples related to Najvan water mill, Jamee Atique mosque, Vafadar and Sokias houses in Isfahan, Shahrestanak palace and Dozdband castle in Karaj, sefid mosque in Maraghee, and Esmaeilabad and Mehrabad mosques in Bonab. In the second phase Effectiveness of treatments were evaluated. Appropriate treatments were studied in historic samples in the third phase to provide interpretation of results and achieve an effective conservation consequence in the fourth phase. Historic samples were identified as Poplar wood. Weathering on historic samples has caused to degradation of lignin and then cellulose. White poplar wood (*Populus alba* L.) was applied for preparation of test samples. Samples were treated with CrO_3 (5% solution in water), Linseed oil (pure), Borax (5% solution in water), Dimethyl silicone (pure), TiO_2 nanoparticles in the form of anatase, rutile and their mix (separately, 1% dispersion in isopropanol), ZnO nanoparticles (1% dispersion in isopropanol), diethanolamine (10% solution in ethanol), Benzotriazole (2% solution in water), UV absorber (2% solution in toluene), hindered amine light stabilizer (2% solution in toluene), phenolic and phosphite antioxidants (separately, 1% solution in toluene). Effect of treatments on the wood and their resistance against artificial weathering were investigated for application assessment of treatments. Studies were done by evaluation of treatment adsorption (impure and pure), equilibrium moisture content (ISIRI 2895), density (ISIRI 3042), water absorption (ISIRI 809), extractives (TAPPI T204-OM88 and TAPPI T207-OM88), leaching (BS EN 84:1997), swelling (ISIRI 2896), shrinkage (ISIRI 2898), pH measurement (Sithole; Campbell and Bryant methods), artificial weathering (ASTM 2565-99) and successive mass loss, colorimetry, ATR-FTIR spectroscopy and scanning electron microscopy. Results indicated effectiveness of anatase TiO_2 nanoparticles, hindered amine light stabilizer (HALS), diethanolamine (DEA) and antioxidant treatments against weathering. Study of these treatments in historic samples showed that treatment with phosphite antioxidant has great properties against degradation of weathering. Also, HALS DEA treatments have appropriate advantages for conservation purposes.

Keywords: Conservation, Hardwood, Photochemical Weathering, Treatment