Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

1475 N. Scottsdale Road, Suite 200
Scottsdale, AZ 85287-3538
Phone: 480 884 1996 Fax: 480 884 1984

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Inventors

Marvin Burton
Christian Hoover
Elham Fini

Contact

Shen Yan
shen.yan@skysonginnovations.com

Oil-Treated Plastic for Concrete (OTPC)

Background

Concrete is typically composed of sand, rocks, water, and cement. It has many commercial uses, but its production has a large environmental cost. Cement is the ingredient that binds the sand and rock together and is made by the process of crushing and burning limestone, which has a high CO2 footprint. The annual amount of cement produced each year is expected to increase due to the high demand from growing populations. Concrete can withstand very high compressive loads, but has poor ability to resist tension and bending. As a result, concrete is often reinforced with steel bars, but the rising cost of steel makes this approach expensive.

Small volume fractions and diameters of plastic particles (PP) have previously been used to fill pores in concrete. However, simply adding PP to concrete can have adverse effects that result in reduced mechanical performance. These particles do not effectively adhere to one another or to the hydrating cement which increases the porosity in concrete, thereby decreasing its density and amplifying stresses. Thus, environmentally friendly, low-cost alternative methods for improving the mechanical properties in concrete are needed.

Invention Description

Researchers at Arizona State University have developed a method of making oil-treated plastic for concrete (OTPC), which involves treatment of waste plastics using oil to be used in applications for concrete. This method is a sustainable way to recycle waste plastics using waste soy oil. The oil-treated plastic can be utilized as a partial replacement for cement, sand, or fine aggregates in concrete manufacturing. OTPC binds with calcium-silicate hydroxide in cement, which increases the load bearing properties of concrete. OTPC can enhance the tensile strength, ductility, and durability, reduce shrinkage and cracking in the concrete, retain moisture in the concrete, and increase resistance to corrosive chemicals and water. OTPC can be incorporated into concrete production processes without disruption to the manufacturing plant and without on-site and labor-intensive installation.

Potential Applications

- Concrete construction (partial replacement for cement and/or sand)
- Sustainable plastic recycling

Benefits and Advantages

- Sustainable way to divert waste plastics from landfills
- Low-cost alternative for plastic recycling and for concrete production

- Enhance performance of construction elements (e.g., concrete) by:
- Increasing toughness
- Reducing shrinkage cracking
- Retaining moisture for improved internal curing