SUMMARY OF THE PRESENT INVENTION

The present invention features a polymer concrete sewer pipe, comprising an external column and internal column forming a mould, wherein the mould has a cavity; a plurality of locking mechanism on the external column for securing said external column; and a polymer concrete mixture comprising resin binder, aggregates, and auxiliary ingredients, characterised in that, the external column of the mould is a steel jacket, wherein the polymer concrete mixture casted into the cavity of the mould, and cured to form an overlay of one part of the removable locking mechanism, wherein the locking mechanism (102) is an anchorage comprising a nut and a locking screw disposed on an inner wall of the steel jacket (103), and the steel jacket confers additional strength for load bearing, and protection against external corrosion to the polymer concrete sewer pipe.

Preferably, resin binder content of the polymer concrete sewer pipe is 9-18%.

Preferably, an aggregate content of the polymer concrete sewer pipe is 82-91%.

Preferably, auxiliary ingredients of the polymer include at least one catalyst, polymerisation inhibitor, and additive.

Preferably, the aggregate of the polymer concrete sewer pipe comprises sand, gravel, or crushed stones.

Preferably, the steel jacket of the polymer concrete sewer pipe is made of corrosion-resistant alloy including stainless steel and mild steel.

Preferably, the locking mechanism is an anchorage comprising a nut and a locking screw disposed on an inner wall of the steel jacket.

Preferably, the polymer concrete sewer pipe comprises an internal glass-reinforced plastic (GRP) liner for additional protection to an internal wall of said polymer concrete sewer pipe.

Preferably, the polymer concrete sewer pipe is connected to another polymer concrete sewer pipe via a steel sleeve or a GRP sleeve.

Further, an embodiment of the present invention provides a method for producing a polymer concrete sewer pipe, comprising steps of preparing an external column and an internal column to form a mould, wherein the mould has a cavity, securing a plurality of locking mechanisms on the external column, mixing resin binder, aggregates, and auxiliary ingredients for obtaining a polymer concrete mixture, pouring the polymer concrete mixture into the cavity of the mould, casting the polymer concrete mixture in the mould, vibrating the mould for compaction and air removal, and curing the polymer concrete mixture for obtaining the polymer concrete sewer pipe, characterised in that the external column of the mould is a steel jacket, wherein the steel jacket confers additional strength for load bearing, and protection against corrosion the polymer concrete sewer pipe, the locking mechanisms (102) is an anchorage comprising a nut and a locking screw disposed on an inner wall of the steel jacket (103), and the cured polymer concrete sewer pipe is removed from the internal column of the mould when the polymer concrete mixture is strong enough as the temperature of the polymer concrete mixture reaches its peak and begins to solidify and cool down gradually.

The present invention consists of features and a combination of parts hereinafter fully described and illustrated in the accompanying drawings, it being understood that various changes in the details may be made without departing from the scope of the invention or sacrificing any of the advantages of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

To further clarify various aspects of some embodiments of the present invention, a more particular description of the invention will be rendered by references to specific embodiments thereof, which are illustrated in the appended drawings. It is appreciated that these drawings depict only typical embodiments of the invention and are therefore not to be considered limiting of its scope. The invention will be described and explained with additional specificity and detail through the accompanying drawings in which:

Figure 1 illustrates the perpendicular and parallel cross-sections of a polymer concrete sewer pipe with a steel jacket having a locking mechanism.

Figure 2 illustrates the process of producing the polymer concrete sewer pipe with a steel jacket having a locking mechanism.

DETAILED DESCRIPTION OF THE INVENTION

The general principles of the present invention relate to an external steel jacket for polymer concrete sewer pipes to solve problems associated with increased pipe thickness required for special installations requiring the ability to sustain high loads, long lifespan, and increased external protection.

Polymer concrete is a composite of aggregates and Unsaturated Polyester Resin (UPR). The manufacturing of polymer concrete does not require cement and water. A cured resin binder effectively binds aggregates and fillers together giving polymer concrete a strength three times greater than conventional cement concrete.

Polymer concrete can be cast into various shapes, making it ideal for producing prefabricated structures. Polymer concrete has high strength and is highly resistant to corrosion inflicted by sewage and ground water, therefore ideal for sewer and manhole applications.

There are two conventional options that are typically considered for providing protection and additional strength to sewer pipes. The first option is using a very thick pipe (example: 100 mm increased thickness over the normal pipe thickness). This option is costly in terms of pipe material, and pipe handling due to the greatly increased weight. The installation of thick pipes requires a larger and more expensive machine. Consequently, this increases the amount of native soil to be removed, and emissions of carbon dioxide. The second option is using sleeve pipes to provide additional protection. However, this option increases installation time, and material cost.

Polymer concrete does not adhere well to any type of steel jackets that are typically used for concrete pipes. The present invention provides a locking mechanism that secures the steel jacket to the polymer concrete successfully.

The present invention provides a polymer concrete sewer pipe having a steel jacket. The steel jacket may be made of stainless steel or mild steel. The polymer concrete sewer pipe is suitable for installation using the pipe jacking or micro-tunnelling (trenchless) method. A locking mechanism using locking screws is incorporated within the steel jacket for providing anchorage of the steel jacket to the polymer concrete sewer pipe. The number of locking screws may be increased or decreased depending on the pipe diameter, and anticipated jacking loads. The locking mechanism would be sufficiently strong to withstand friction during the jacking process.

Further, a locking mechanism is disposed to the steel jacket to ensure said steel jacket remains attached to the polymer concrete sewer pipe at all times.

The preferred embodiment of the present invention provides a polymer concrete sewer pipe having a 10-mm steel jacket. The jacket material may be mild steel or stainless steel. Therefore, a thickness of 10 mm is sufficient for its intended application. However, the thickness of the steel jacket may be adjusted to suit the needs of different pipeline applications. The amount of native soil required to be removed during the jacking process is minimal, i.e., up to 10%. This provides substantial savings in machine costs due to the reduced size requirement, and reduced amount of native soil removed during jacking.

The present invention is also economical and versatile because it makes jacking of a combination of pipes possible, i.e., enables a connecting of standard polymer concrete sewer pipes to polymer concrete sewer pipes with steel jackets.

Another embodiment of the present invention provides a polymer concrete sewer pipe comprising an internal glass-reinforced plastic (GRP) liner which provides additional protection to the polymer concrete sewer pipe against corrosion as well as improved flow properties, and a steel jacket having a locking mechanism for anchoring said steel jacket to the polymer concrete

sewer pipe, wherein the locking mechanism ensures that the steel jacket withstands friction during the jacking process of the polymer concrete sewer pipe. This steel jacket provides additional strength to the polymer concrete sewer pipe.

Preferably, the resin binder content of the polymer concrete sewer pipe is 9-18%.

Preferably, the aggregate content of the polymer concrete sewer pipe is 82-91%.

Preferably, the resin binder is an unsaturated polyester resin (UPR).

Preferably, the polymer concrete sewer pipe comprises auxiliary ingredients including at least one catalyst, polymerisation inhibitor, and additive.

Preferably, the aggregate of the polymer concrete sewer pipe comprises sand, gravel, or crushed stones.

Preferably, the steel jacket of the polymer concrete sewer pipe is made of corrosion-resistant alloy including stainless steel and mild steel.

Preferably, the locking mechanism is an anchorage comprising a nut and a locking screw disposed on the inner wall of the steel jacket.

Further, the polymer concrete sewer pipe comprises an internal GRP liner for additional protection to the internal wall of the polymer concrete sewer pipe against sewage and corrosion, as well as for improved flow.

Preferably, the polymer concrete sewer pipe is connected to another polymer concrete sewer pipe via a steel sleeve or a GRP sleeve.

Referring to Figure 1, the preferred embodiment of the present invention provides a polymer concrete sewer pipe (101) that is protected by a steel jacket (103) secured with at least one locking mechanism (102). The polymer concrete sewer pipe (101) is to be connected to another via at least one steel sleeve (104) having a rubber ring disposed at the spigots of each polymer concrete sewer pipe (103). The perpendicular cross section of the present invention demonstrates that the steel jacket (103) forms the outermost or external layer, while the polymer concrete sewer pipe (101) is disposed to the internal diameter of said steel jacket (103). Therefore, the diameter of the steel jacket (103) is larger than that of the polymer concrete sewer pipe (101). The steel jacket (103) is attached and secured to the polymer concrete sewer pipe (101) using the locking mechanism (102) which comprises a nut (102a) and a locking screw (102b). The parallel cross section of the present invention demonstrates a preferred embodiment of the steel jacket (103) secured to the polymer concrete sewer pipe with multiple locking mechanisms (102) around the external diameter or external wall of said steel jacket (103) for reducing stress exerted on said locking mechanisms.

Referring to Figure 2, the preferred embodiment of the present invention provides a method producing a polymer concrete sewer pipe having a steel jacket. Firstly, the steel jacket is prepared by securing a plurality of locking mechanisms to said steel jacket (201). A mould is prepared for casting (202), in which the mould comprises elongated internal and external columns for forming a cavity. A polymer concrete mixture comprising resin binder, aggregates, and auxiliary ingredients is to be casted (203) in between the internal and external columns of the mould. The external part of the mould is the steel jacket secured with the locking mechanisms. The internal column is either a removable steel cylinder, or a GRP liner/pipe which would become an inseparable part of the polymer concrete sewer pipe. The polymer concrete mixture can be casted into the mould of any chosen diameter and thickness. During the casting process, the entire setup of polymer concrete mixture casted into the mould is vibrated (204) continuously to compact the material and remove air pockets. After

casting, the polymer concrete mixture is left to cure (205) at room temperature between 30 minutes to 2 hours depending on the type of resin used. During the curing process, an exothermic reaction takes place; thus, heat is generated. As the temperature of the polymer concrete mixture reaches its peak, it begins to solidify as well as cool down gradually. Once it is strong enough, the cured polymer concrete sewer pipe together with the steel jacket can be removed from the internal column of the mould.

The present invention may be embodied in other specific forms without departing from its essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore indicated by the appended claims rather than by the foregoing description. All changes, which come within the meaning and range of equivalency of the claims, are to be embraced within their scope.