

## PURAFLO SPENT PEAT REPLACEMENT WITH COIR FIBER TL-2 OR TL-3 CORRELATION JUSTIFICATION

### PURPOSE

To demonstrate that coconut fiber (coir) is a suitable alternative to peat fiber for use in Puraflo biofilters rated for TL-2 or TL-3.

### OVERVIEW

Puraflo systems have been used extensively throughout the Commonwealth of Virginia since 1995. Puraflo is an advanced secondary treatment system or tertiary polishing filter that purifies septic tank effluent or ATU effluent to an extremely high degree before final dispersal. A typical system consists of:

- Septic tank or ATU with 1/32" filtration;
- Pump tank with timed dose pump for distributing effluent onto the natural media;
- Biofilter modules where treatment occurs due to the physical, chemical, and biological processes that are optimized by the natural media;
- Site specific effluent dispersal.

The filtered effluent is collected under gravity in the pump tank. A timed dosing system is activated by a programmable timer or a siphon-dose system triggers, which pumps the effluent through a flow splitting inlet manifold located at the base of the treatment modules. An orifice plate is located inside the top of each inlet manifold which allows the flows to be split equally, and fed simultaneously to each biofilter module. The inlet manifold is connected to the base of the biofilter module and is fed upwards to a rectangular distribution grid. When coconut fiber is used as replacement media, the distribution grid will be replaced with a new grid containing four helical spray nozzles, which enhances effluent distribution and improves performance. The effluent percolates laterally and vertically through the depth of the treatment media and emerges as a clear, innocuous liquid from the base of the system. Treated effluent is collected and dispersed.



*Figure 1: Replacement Grid with Helical Spray Nozzles*

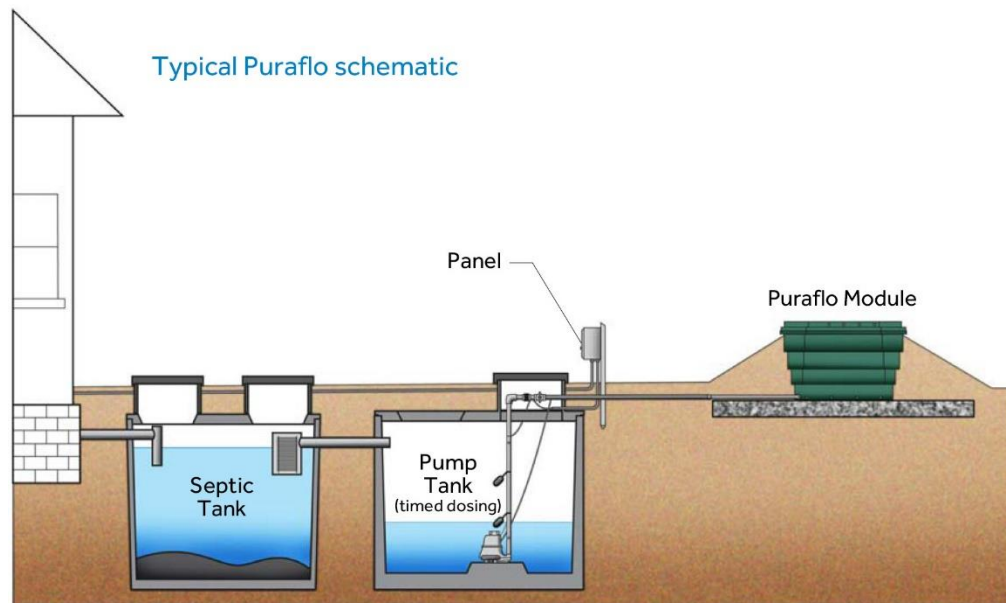


Figure 2: Typical Layout

## TREATMENT MECHANISMS

The Puraflo treatment technology is based on simple, passive biofiltration principles using a single pass configuration. BOD<sub>5</sub> and TSS treatment is achieved by a combination of unique physical, chemical, and biological interactions between the effluent and the fibrous media. As part of routine Puraflo system maintenance, the spent peat will be replaced with coir (coconut) fiber. Coconut fiber is a by-product of coconut harvesting in developing nations and is a renewable resource. The short-to-medium length fibers are a lignocellulosic material. The high lignin content of these fibers results in a strong, durable material with typical lifespan of 10 years. The coconut fiber media properties are comparable to peat fiber in terms of lignin content, surface area, and void space. In fact, coconut fiber may be hydraulically loaded many times higher than peat fiber without detrimental effects to the media. Furthermore, the design hydraulic loading (125 gpd/module and 70 ft<sup>3</sup> media per module) in the single pass configuration is 1.8 gpd/ft<sup>3</sup> compared to 5.88 to 15 gpd/ft<sup>3</sup> for the recirculating configuration used for third party tested Quanics BioCoir systems. Due to the low hydraulic loading rate and comparability of the media, coconut fiber is a suitable alternative to peat fiber for use in the Puraflo system.

Tricel Ireland completed European EN 12566-3 testing using on their Seta units using Quanics coconut fiber in July 2015. Tricel entered into a licensing agreement to use Quanics coconut fiber (agreement has since expired). Per Anua's calculations, the



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treatment media volume was approximately 80 cubic feet (6.6'L x 5'dia x 3'H media). The treatment unit 100% loading was 0.6 m<sup>3</sup>/d or 160 gals/d. The hydraulic loading equals 2.0 gpd/ft<sup>3</sup>. Note, the Tricel Seta unit is gravity fed with a tipping tray and distribution network. Puraflo with coconut fiber will utilize timed dosing and a helical spray nozzle network.

| Parameter                       | Puraflo with Peat Fiber           | Puraflo with Coconut Fiber        | Tricel Seta with Coconut Fiber Per EN 12566-3 |
|---------------------------------|-----------------------------------|-----------------------------------|---|
| Primary treatment (septic tank) | Yes                               | Yes                               | Yes   |
| Effluent screening              | Effluent filter 1/32" filtration  | Effluent filter 1/32" filtration  | Effluent filter                               |
| Timed dosing (doses per day)    | 12                                | 12                                | N/A - Gravity                                 |
| Hydraulic loading               | 1.8 gpd/ft <sup>3</sup>           | 1.8 gpd/ft <sup>3</sup>           | 2.0 gpd/ft <sup>3</sup>                       |
| Organic loading                 | 0.125 to 0.209 lbs/d <sup>x</sup> | 0.125 to 0.209 lbs/d <sup>y</sup> | 0.463 lbs/d                                   |
| Media lignin content            | ~50%                              | ~45%                              | ~45%  |
| Media void space, min           | 90%                               | 90%                               | 90%   |

<sup>x,y</sup>SH&DR defines septic tank effluent as "effluent characterized by a five-day biochemical oxygen demand between 120 and 200 mg/l"

## TREATMENT PERFORMANCE

The purpose of third-party testing is to benchmark system performance and provide reasonable assurance that a listed model will comply with effluent performance standards. When comparing performance results, it should be noted that systems tested under EN 12566-3 are subject to frequent, severe hydraulic loading conditions. Furthermore, influent constituents are significantly higher than typical influent constituents at U.S. testing centers that administer Standard 40 or other protocols such as Virginia's TL-3. The table below summarizes testing protocol parameters.

**Testing Protocol Comparison Table**

| Parameter                       | EN 12566-3      | NSF 40 (TL-2)   | Virginia TL-3 |
|---------------------------------|-----------------|-----------------|---------------|
| Testing Period                  | 38 weeks        | 26 weeks        | 52 weeks      |
| BOD <sub>5</sub> influent range | 150 to 500 mg/l | 100 to 300 mg/l | SH&DR         |
| TSS influent range              | 200 to 700 mg/l | 100 to 350 mg/l | SH&DR         |



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|   |                                  |             |       |
|---|----------------------------------|-------------|-------|
| TKN influent range, or NH <sub>4</sub> -N influent range            | 25 to 100 mg/l, or 22 to 80 mg/l | No criteria | N/A   |
| TP influent range   | 5 to 20 mg/l                     | No criteria | N/A   |
| Grinder effluent allowed?   | No                               | Yes         | Yes   |
| Weekly surge during normal flow period (min >53 gals during 3 mins) | Yes                              | No          | N/A   |
| Sampling during stress periods?                                     | Yes                              | No          | N/A   |
| Tank/vessel structural integrity testing?                           | Yes                              | No          | SH&DR |

The influent averages (nominal 100% loading) for Tricel Seta using Quanics Coconut Fiber was 434 mg/l BOD<sub>5</sub> and 530 mg/l TSS. These values exceed NSF and Virginia TL-3 averages. Because of this, percent reductions can be applied to estimate effluent values for Puraflo with coconut fiber.

**Probable Maximum Effluent Quality Values Table  
(per application of % reduction to SH&DR septic tank effluent values)**

| Parameter   | BOD <sub>5</sub>   | TSS   |
|---|--|---|
| <b>SH&amp;DR septic tank effluent</b>   | 120 – 200 mg/l   | 70 – 150 mg/l   |
| <b>NSF Standard 40 influent, max</b>  | 300 mg/l   | 350 mg/l  |
| <b>Reduction (per PIA EN 12566-3 testing)</b>   | 97.1%  | 98%   |
| <b>SH&amp;DR septic tank effluent</b><br>Probable maximum effluent value per normal or nominal testing % reduction (per PIA EN 12566-3 testing) | 120 x (100%-97.1%) = 3.5 mg/l<br>200 x (100%-97.1%) = 5.8 mg/l | 70 x (100%-98%) = 1.4 mg/l<br>150 x (100%-98%) = 3.0 mg/l |
| <b>NSF Standard 40 influent, max</b><br>Probable maximum effluent value per normal or nominal testing % reduction (per PIA EN 12566-3 testing)  | 300 x (100%-97.1%) = 8.7 mg/l                                  | 350 x (100%-98%) = 7 mg/l                                 |

**SUMMARY**

The evidence documented in the sections above indicates a high probability of achieving less than 10 mg/l BOD<sub>5</sub> and 10 mg/l TSS per TL-3 requirements. The evidence can be

summarized as follows:

1. Due to the low hydraulic loading rate and comparability of the media properties, coconut fiber is a suitable alternative to peat fiber for use in the Puraflo system
2. The new effluent distribution method utilizing helical spray nozzles will improve performance
3. Correlating Tricel Seta gravity system (utilizing Quanics coconut fiber) percent reductions to SH&DR septic tank effluent values or NSF Standard 40 values demonstrates theoretical effluent quality values below TL-3 requirements
4. Hydraulic and organic loading rates are lower than the values during the Tricel Seta EN 12566-3 testing
5. Timed dosing is expected to enhance performance

## NOTE

The Tricel Seta EN 12566-3 test report and data analysis spreadsheet provided courtesy of Tricel Ireland. Tricel has requested that these two documents remain confidential as they contain proprietary information. They have given permission for the Virginia Department of Health to use them for Anua's request.

