What is the maximum fiber volume fraction $V_f$ that could be obtained in a unidirectionally reinforced with optimal fiber packing?

Consider a triangular area inscribed on a close-packed section as shown. The enclosed fiber area includes half of the three circles located on the midsides, and one-sixth of the three circles at the vertices. The area of fibers in the triangle is then

$$A_f := (3*(1/2)+3*(1/6)) * \pi * r^2;$$

$$A_f := 2 \pi \ r^2$$

The area of the equilateral triangle, with sides of $4r$, is

$$A_t := 4 * r^2 * \sqrt{3};$$

$$A_t := 4 \ r^2 \sqrt{3}$$

Packing density is then

$$\text{Digits} := 4; \ p := \text{evalf}(A_f/A_t);$$

$$\rho := .9072$$