EVALUATION OF SECONDARY SHREDDING TO ENHANCE RDF PRODUCTION AS FUEL FOR CEMENT KILNS — A RESEARCH TEST

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Of the 17 tests performed, 10 met the requirement that 95 percent of the product be less than 1 in. (25 mm). Of those 10, the conclusion reached by the author was that run number 6, which consisted of two-stage shredding, was the most acceptable since its throughput of 9.2 tons/hr approached the required feed rate of 10 tons/hr. None of the tests with a single shredder achieved the desired product particle size while simultaneously attaining the necessary solids feed rate.

The conclusion was stated as follows: “As a result of this program, it has been demonstrated that production of RDF from solid waste can be enhanced by a series shredding system.” I wish to take exception with this conclusion.

One means of measuring shredder efficiency is to calculate the Bond Work Index \( E_i \) [1]. Defined by the equation

\[
E_i = 10 E_i \left( \frac{1}{\sqrt{L_p}} - \frac{1}{\sqrt{L_F}} \right)
\]

where \( E = \) power input to the shredder kWh/ton

\( L_p = \) product particle size at 80 percent finer, microns

\( L_F = \) feed particle size at 80 percent finer, microns

The \( E_i \) for typical solid waste shredders is about 300 to 500 kWh/ton [2]. A smaller \( E_i \) is indicative of higher efficiency.

Plotting the author’s data for runs for which the 95 percent less than 1 in. was attained (Fig. 1) allows the estimation of \( L_p \). The feed particle size was not stated, but it is not unreasonable to select \( L_F \) as 10 in. This is a conservative estimate, and will yield \( E_i \) values which will not be overly optimistic.

Calculating \( E_i \) in this manner, the following results are obtained:

<table>
<thead>
<tr>
<th>Run No.</th>
<th>( E_i ) (kWh/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>5803</td>
</tr>
<tr>
<td>4</td>
<td>594</td>
</tr>
<tr>
<td>5</td>
<td>4862</td>
</tr>
<tr>
<td>6</td>
<td>469</td>
</tr>
<tr>
<td>8</td>
<td>330</td>
</tr>
<tr>
<td>10</td>
<td>277</td>
</tr>
<tr>
<td>11</td>
<td>1783</td>
</tr>
<tr>
<td>12</td>
<td>1068</td>
</tr>
<tr>
<td>14</td>
<td>1600</td>
</tr>
<tr>
<td>15</td>
<td>1250</td>
</tr>
</tbody>
</table>

On the basis of these calculations, it seems that the most efficient results were obtained in runs...
number 8 and 10. Both of these runs used the Heil shredder alone.

The author selected the results of run number 6 as the desired result, since it alone approached the required 10 tons/hr throughput. This run represents a reasonably efficient configuration, while, with the exception of run number 4, the other combinations of two shredder series are totally out of the usual efficiency range and represent highly inefficient systems.

The two most efficient runs, 8 and 10, were both with the Heil shredder alone. The throughputs were 5.03 and 5.68 tons/hr respectively, with horsepower requirements of 125 and 118. If we double these throughputs by adding another identical shredder, we can achieve both the required feed rate of 10 tons/hr, and the desired particle size reduction. The horsepower requirements would then be 250 and 236 hp. This is considerably lower than the less efficient system of two shredders in series (run number 6) which required 441 hp.

In conclusion, the author's statement that the data show the benefit of using two shredders in series is clearly in error. A much more efficient system would have been to simply use two Heil shredders in parallel.

REFERENCES


AUTHOR'S REPLY

Dr. Vesilind is correct in his statement that "A more efficient system would have been to simply use two Heil Shredders in Parallel"; however, the object of the program was not to determining the most efficient production method, but to increase production with existing equipment by any method at a minimum expenditure of capital.

The object of the test program, as stated in the paper was "To increase production capacity to a rate of 10 tons/hr while maintaining a fuel particle size distribution equal to that material processed thru the Gruendler with 1 in. diameter grates."

Obviously, this demonstration has enhanced the plant production of RDF from the original rate of 4 tons/hr by increasing production rate to almost 10 tons/hr.

Capital considerations would not allow the purchase of a second shredder, and only one Heil Shredder was available on loan from the U.S. Army Construction Engineering Research Lab.

The data does show the benefit of using the two shredders in series over the available two shredders in parallel, since neither shredder by itself nor together in parallel was capable of producing the required production rate at the required particle size for the same required power input.