A braai-wood index

Martina Meincken tells us which braai-woods are fine and which are not.

Take any sunny weekend anywhere in South Africa and the smells of burning wood and roasting meat are sure to permeate the neighbourhood, as people light their fires and indulge in our national pastime – the braai.

The wood used is usually bought in the local shop or by the roadside and its choice often depends on individual preference, habit or tradition. But perhaps we should also be looking at the best wood to use to satisfy environmental concerns.

To shed some scientific light on the differences in types of braai-wood, we investigated five wood species typically used in the Western Cape. We looked at their energy content as well as the environmental impact of burning this wood.

The wood is often sold by its common name and the exact species is not known – the species investigated were rootiknys (Acacia cyclops), camelthorn (Acacia erioloba), blue- or sugar gum (Eucalyptus cladocalyx), pine (Pinus patula) and vine stumps (Vitis vinifera). All are widely available in the Western Cape and commonly sold at the roadside or in shops.

The density, ash content and elemental composition were determined and related to the calorific value. We showed that the wood with the highest calorific value was not necessarily the best option for the braai, if environmental factors are also taken into account.

The calorific value of wood can be related to its chemical composition and varies between 17 – 20 MJ/kg for oven-dry wood. Major elements contributing to the calorific value are carbon, hydrogen and oxygen, whereas nitrogen and some inorganic components contribute to toxic waste gases. Elemental analysis can be used to determine the amount of those components in biomass fuels and to estimate their expected impact on the environment. The typical elemental composition of wood is approximately 51% carbon, 40% oxygen, 6% hydrogen, 0.2% nitrogen and inorganic components that will remain as ash (typically < 1%).

Good braai-wood should ideally have a high carbon content and a high density, since this implies a high energy content and a slow burning process – or in other words, hot and slow-burning coals. Ideally the ash content should be low, so that as much of the available wood is burnt and...
converted into energy as possible. During the burning process, many toxic waste gases are emitted. These range from carbon monoxide (CO) to nitrogen oxides (NOx), which contribute to the greenhouse effect, leading to acid rain and negatively affecting human health. In this study the nitrogen content of the wood species was determined and regarded as an indicator of the degree to which toxic components are formed during combustion.

Apart from the nitrogen content, the presence of metals and other trace elements in the wood samples was determined. Heavy metals such as aluminium, lead, cadmium and arsenic are toxic to humans and the environment.

### Density and calorific values of the evaluated fuelwood species

We looked at the different available firewood types in terms of energy content and environmental impact. We developed a simple credit system for choosing wood by looking at the density, ash content, calorific value and the elemental composition of all the examined wood types. The calorific value of the five evaluated wood species ranged from 18.68 – 19.03 MJ/kg.

### Density and calorific value

<table>
<thead>
<tr>
<th>Wood species</th>
<th>Average density (kg/m³)</th>
<th>Average calorific value (MJ/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rooikrans</td>
<td>800.72</td>
<td>18.99</td>
</tr>
<tr>
<td>Camelthorn</td>
<td>963.13</td>
<td>19.03</td>
</tr>
<tr>
<td>Blue gum</td>
<td>744.62</td>
<td>18.87</td>
</tr>
<tr>
<td>Pine</td>
<td>440.00</td>
<td>18.68</td>
</tr>
<tr>
<td>Vine stumps</td>
<td>597.37</td>
<td>18.73</td>
</tr>
</tbody>
</table>

As expected, a higher density relates directly to a higher calorific value. Camelthorn had the highest density and also the highest calorific value, while pine showed the lowest density and calorific value.

### Ash, carbon and nitrogen content of the evaluated fuelwood species

Vine stumps had the lowest ash content, followed by pine, rooikrans, blue gum and camelthorn. Generally the hardwood species show a higher ash content than the softwoods and vines. The difference in ash content is statistically more significant than the difference in calorific values, which means that the wood with the highest calorific value is not necessarily the best option as firewood. If ash content and calorific value are taken into account, the best option would be rooikrans.

Blue gum has the lowest nitrogen content, followed by pine, camelthorn, rooikrans and vine stumps. The higher the nitrogen content, the more likely is the formation of toxic nitrogen oxides and nitric acid, which have a negative impact on the environment. If calorific value, ash content and nitrogen content are taken into account, bluegum and pine should be the preferred species.

### Metals and other trace elements

The concentration of heavy metals and other trace elements present in the briei-wood differed significantly between the species. Pine had by far the largest aluminium concentration, followed by vine stumps, blue gum, camelthorn and rooikrans. The highest lead concentration could be found in vine stumps, followed by blue gum, camelthorn, pine and rooikrans. The large aluminium and lead concentration in pine and vines, respectively, suggests that they might have a negative impact on health and the environment if they are used extensively as fuelwood. The hardwood species on the other hand have a significantly lower content of aluminium and lead and therefore present a better choice of fuelwood.

The cadmium and arsenic levels are below 0.2 ppm for all species. The highest concentrations could be found in vine stumps and camelthorn, respectively.

If all properties are taken into account and the wood species are ordered accordingly from 1 (best) to 5 (worst), we can devise a simple rating system that allows us to compare the species and decide which is the most suitable briei-wood in terms of energy output and environmental impact.

Based on this rating, the preferred briei-wood species should be rooikrans (3.33), followed by camelthorn (2.44), blue gum (2.56), pine (3.44) and lastly vine stumps (3.89).

Blue gum is classified as a Category 2 invasive species and may be commercially used in specific areas. Since it is not as invasive as rooikrans, it would seem possible to cultivate it specifically for firewood. The continued use of invasive rooikrans, which according to our results constitutes the best choice of fuelwood, will help to clear the existing stock of these plants, which present a real problem on farmland in the Western Cape.

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