# Biomass Ash Alkali Index (Fouling Tendency)

Alkali index in kg of $K_2O$ + $Na_2O$ per GJ from the fuel's ash, the alkali oxides in the ash and the calorific value, with the published fouling thresholds.

**Method:** Miles et al. (1995/1996); alkali deposits in biomass power plants (NREL): AI = ($K_2O$ + $Na_2O$) in kg per GJ of fuel; thresholds 0.17 and 0.34 kg/GJ

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Ash % fuel (as fired) | 6.0000 | % |
| $K_2O$ % ash | 12.000 | % |
| $Na_2O$ % ash | 2.0000 | % |
| Fuel GCV (as fired) | 14,000 | kJ/kg |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Alkali index (kg alkali oxides per GJ) | 0.60000 | kg/GJ |

**Notes for this case**

- Above 0.34 kg/GJ: fouling and slagging virtually certain (Miles et al.).

## Formula and method

$$AI = \frac{A\,(K_2O + Na_2O)}{GCV}$$

### Variables

| | | |
|---|---|---|
| $A$ | Ash % fuel (as fired) | - |
| $K_2O$ | $K_2O$ % ash | - |
| $Na_2O$ | $Na_2O$ % ash | - |
| $GCV$ | Fuel GCV (as fired) | J/kg |
| $AI$ | Alkali index, shown in kg of alkali oxides per GJ (1 kg/GJ = $10^{-9}$ kg/J) | kg/J |

### Method and standards

The alkali index of Miles, Miles, Baxter, Bryers, Jenkins and Oden, Alkali Deposits Found in Biomass Power Plants (NREL, 1995–1996): the mass of $K_2O$ + $Na_2O$ brought in per GJ of fuel heat, with their thresholds of 0.17 kg/GJ (fouling probable) and 0.34 kg/GJ (fouling and slagging virtually certain).

### Assumptions and limits

- Same basis for ash and GCV (both as fired, or both dry); the index is per GJ of gross (higher) heating value. The code cannot check the basis.

### References

- Miles et al. (1995/1996)
- alkali deposits in biomass power plants (NREL): AI = ($K_2O$ + $Na_2O$) in kg per GJ of fuel; thresholds 0.17 and 0.34 kg/GJ

## Report details

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|---|---|
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| Release checks | 3 reference cases of this calculator, computed independently, are checked on every release |

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

### This calculator online

https://calc.firecad.com/boilers-power-plant/combustion/biomass-alkali-index

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.