

# Synergistic effects of biomass and coal dust co-combustion on explosion safety

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## ABSTRACT

The growing share of renewable energy sources in recent years has been driven by the development of national legislation in various countries aiming to reduce carbon dioxide emissions originating from fossil fuels. Sustainable growth of national economies therefore requires the search for novel green technologies. Biomass has recently been used as a supplementary fuel to coal. The literature describes the synergetic effect in the technical context of combustion in the power engineering sector. In the presented research, five types of biomass dust were added to coal dust. The selected explosion indices were determined using a 20 L sphere apparatus, in accordance with EN 14034 standards. The results demonstrate the impact of biomass on the course of dust–air explosions. A synergetic effect was observed and explained. Certain types of biomass were found to be characterized by a higher explosion pressure rise (15-17 % or 0.88-1.28 bar) and higher maximum explosion pressure rates (16-148 % or 57-143 bar/s) than those obtained for the samples tested separately. The results indicate that the implementation of biomass for co-combustion always requires a revision of the existing process safety measures designed for coal combustion.

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# Sinergijski učinki sosežiganja biomase in premogovega prahu na eksplozijsko varnost

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## POVZETEK

Naraščanje deleža obnovljivih virov energije v zadnjih letih je posledica razvoja nacionalne zakonodaje v številnih državah, katere cilj je zmanjšanje emisij ogljikovega dioksida, ki izvirajo iz fosilnih goriv. Trajnostna rast nacionalnih gospodarstev zato zahteva iskanje novih zelenih tehnologij. Biomasa se je v zadnjem času začela uporabljati kot dopolnilno gorivo k premogu. V literaturi je sinergijski učinek opisan v tehničnem kontekstu zgorevanja v energetskem sektorju. V predstavljeni raziskavi je bilo premogovemu prahu dodanih pet vrst biomase v obliki prahu. Izbrani eksplozijski kazalniki so bili določeni z uporabo 20-litrskega sferičnega aparata v skladu s standardi EN 14034. Rezultati prikazujejo vpliv biomase na potek eksplozij mešanic prahu in zraku. Ugotovljen in pojasnjen je bil sinergijski učinek. Pri določenih vrstah biomase je bilo ugotovljeno večje povečanje eksplozijskega tlaka (15–17 % oziroma 0,88–1,28 bar) ter višje največje hitrosti naraščanja eksplozijskega tlaka (16–148 % oziroma 57–143 bar/s) v primerjavi z vzorci, preizkušenimi ločeno. Rezultati kažejo, da uvedba biomase za sosežiganje vedno zahteva revizijo obstoječih procesnih varnostnih ukrepov, zasnovanih za zgorevanje premoga.

## PODATKI O ČLANKU

### Ključne besede:

Biomasa;  
Premogov prah;  
Sosežiganje;  
Eksplozija prahu;  
Sinergijski učinki;  
Eksplozijski tlak;  
Obnovljivi viri energije;  
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