

## Effect of 'Heavy' and 'Light' Water on Luminescence of Bacteria

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### Abstract:

We examined the effects of heavy water (deuterium oxide, D<sub>2</sub>O) and light water (depleted of natural levels of deuterium) on the luminous bacterium *Photobacterium phosphoreum* 1883 (CCIBSO 836) and recombinant *E. coli* containing lux-operon from *P. leiognathi* (in CCIBSO 836). Fresh cultures from agar slants were suspended in solutions (*E. coli* in 0.85% NaCl, *P. phosphoreum* in 3% NaCl) prepared with deionized (ordinary) water as control) and with heavy and light water at 10, 20, 50 and 100% concentrations. Lyophilized preparations of the same cultures were rehydrated with deionized water and with heavy and light water at 1, 2, 5, 10, 20, 50, and 100%. The bioluminescence index (BI =  $I_{exp}/I_{contr}$ ) was calculated as an indicator of the effects of heavy and light water on the organisms. Effect is considered toxic if BI  $\leq 0.8$  or BI  $\geq 1.2$ . In *P. phosphoreum* heavy and light water both initially inhibited recovery from lyophilization with luminescence strongly suppressed for 24h, regaining normal levels after 48h in light water, but remaining strongly suppressed after 72h in high levels of D<sub>2</sub>O ( $\geq 50\%$ ). In *E. coli* recovery from lyophilization also was initially inhibited in both light and heavy water, but luminescence resumed normal values after 4 hours except at the highest level of D<sub>2</sub>O (100%). In suspensions from living cultures of both strains luminescence was initially stimulated by light water returning to normal (control) levels after 24h in *E. coli*, and after 45h in *P. phosphoreum*. Luminescence was strongly stimulated by heavy water, remaining so in *P. phosphoreum* over the course of our observations at all levels of D<sub>2</sub>O and in *E. coli* at D<sub>2</sub>O concentrations  $\geq 50\%$ . Stimulation of BI could be explained by a toxic effect of these waters, particularly heavy water at higher concentrations, connected with production of active forms of oxygen by cells in adverse environmental conditions.

**Key words:** biotesting, luminous bacteria, heavy water, light water