ABSTRACT:
Diacetyl and 2,3-P (2,3-P) are two of over 1,000 volatile components generated naturally in food products through thermal processing via the Maillard reaction, and/or fermentation processing. Diacetyl has also been used as a food flavoring and odorant additive, and the FDA (US Food and Drug Administration) lists it as Generally Regarded as Safe (GRAS) when ingested. However, the association between occupational exposure to diacetyl and 2,3-P and impaired respiratory function continues to be a subject of study and debate. Since literature on the exposure to naturally generated diketones from food products is scarce, we 1) performed a literature review to summarize the headspace concentrations of diacetyl and 2,3-P in thermally processed or fermented food products; 2) derived precautionary (worst case) indicators of short-term (15 minutes or less) inhalation exposure potential expressed as an airborne concentration; and 3) ranked the inhalation exposure potential for future exposure assessment. The exposure indicators were based on reported food headspace concentrations, typical serving sizes, and human breathing zone volume. Food products containing diacetyl or 2,3-P as artificial flavoring/additives were excluded from the analysis. We identified a total of 15 studies in which naturally generated concentrations of diacetyl and 2,3-P were reported in dairy, bread, beer, coffee, and other food products. The resulting exposure indicators were: i) 0.028-213.7 ppb and 2.7-7.7 ppb, respectively, in dairy products; ii) 2.48-143.1 ppb and 2.61-84.0 ppb, respectively, in whole, ground, and brewed coffee; iii) 1.7-9.6 ppb and 3.12 ppb, respectively, in beer; iv) 0.112-3.04 ppb diacetyl in other food products (including French fries, safflower oil, and almonds); and v) 1.2-1.5 ppb and 0.72-1.01 ppb, respectively, in bread. When compared to current short-term (15-minute) occupational exposure guidelines, the exposure ranking suggests a relatively low priority for characterizing naturally occurring diacetyl and 2,3-P exposures associated with most food products. In contrast, more research may be helpful to better characterize airborne exposures associated with consuming or preparing dairy products, as well as to supplement the currently available literature on coffee preparation and consumption.