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Determination of total arsenic in urine by hydride generation atomic fluorescence spectrometry: Comparison between on-line microwave assisted heating and on-line UV-photooxidation

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Arsenic (As) exists as many different chemical forms including both inorganic and organometallic species. Their toxicity varies, inorganic As is a potential toxin that can cause adverse effects in many parts of the body, while complex organoarsenics are considered relatively non-toxic. Monitoring As exposure is usually accomplished by the direct measurement of total As in urine. Therefore it is important to develop improved and reliable methods for measuring As in urine. Hydride generation atomic fluorescence spectrometry (HG-AFS) has the advantages of lower cost, simplicity, good precision, and an acceptable detection limit over other commonly used spectrometric techniques. However, only four As species form volatile hydrides: As (III); As (V); monomethylarsonic acid (MMA); and dimethylarsinic acid (DMA). Seafood often contains a large amount of arsenobetaine (AsB) and arsenocholine (AsC). Thus, after consuming seafood, urinary concentrations of AsB and AsC can be high but HG-AFS methods cannot detect them directly. To accomplish detection, it is necessary to convert organoarsenics into hydride forming species. Two possible approaches are (a) on-line microwave assisted heating and (b) on-line UV-photooxidation in the presence of oxidant ($K_2S_2O_8$).

Current work is focused on optimization of the system for the determination of total As in urine specimens. The concentration of acid (HCl) and reductant ($NaBH_4$) are the key parameters for optimizing HG. The best signal-to-noise ratio was obtained with 15 % (v/v) HCl and 1.0 % (w/v) $NaBH_4$. The optimal concentration of $K_2S_2O_8$ for both microwave and UV approach was at 3.75 % (w/v).