CHEMICAL AND RADIOCHEMICAL EVALUATION OF
THE PURITY OF $^{99m}$Tc EXTRACTED BY MEK

D. V. S. NARASIMHAN, R. S. MANI

Isotope Division, Bhabha Atomic Research Centre,
Trombay, Bombay (India)

(Received October 15, 1975)

Solvent extraction separation of $^{99m}$Tc from $^{99}$Mo using methyl ethyl ketone (MEK) has been found to be an effective method of obtaining $^{99m}$Tc of medicinal purity from low specific activity $^{99}$Mo. The authors have investigated the effect of alkali and molybdate concentration on the extraction of $^{99}$Mo and $^{99m}$Tc into methyl ethyl ketone. The possibility of methyl ethyl ketone forming enol and condensation products and its effect on the final extraction efficiency and purity of $^{99m}$Tc has been studied. Sodium molybdate has been found to have a good salting out effect on $^{99m}$Tc pertechnetate and hence $^{99m}$Tc extraction can be better accomplished from low specific activity $^{99}$Mo solutions. The ketone seems to form traces of condensation products in the extraction procedure. These have been found to be coextracted with $^{99m}$Tc into MEK but did not affect the extractability of $^{99m}$Tc. It was observed that neutral alumina column removes these condensation products from MEK containing $^{99m}$Tc. Alternately these could be filtered off by acidification of the final aqueous $^{99m}$Tc solution. The studies indicate that under optimum experimental conditions methyl ethyl ketone separates $^{99m}$Tc from $^{99}$Mo with high efficiency and yields $^{99m}$Tc of high purity suitable for use in nuclear medicine in the form of various labelled compounds.

Introduction

$^{99m}$Tc has been extensively used in diagnostic nuclear medicine and gives superior scintiscans with less radiation exposure to patients. It is obtained by the beta decay of reactor-produced $^{99}$Mo or by the proton bombardment (in a cyclotron) of enriched $^{100}$Mo. However, production of $^{99}$Mo in the reactor by the neutron irradiation of $^{98}$Mo, natural or enriched, or by fission of $^{235}$U or $^{239}$Pu is the method preferred for obtaining large quantities of $^{99}$Mo. The separation of $^{99m}$Tc from $^{99}$Mo is
achieved chiefly using three methods: 4 (a) column chromatography using alumina, (b) sublimation of volatile technetium heptoxide, and (c) selective extraction of $^{99m}$Tc into methyl ethyl ketone (MEK). The chromatographic method using alumina has been well explored and sterile generators for use in hospitals are available commercially. 5

The solvent extraction procedure offers several advantages where low specific activity $^{99}$Mo has to be used. Using this procedure it is possible to obtain large quantities of $^{99m}$Tc with high yield and radioactive concentration, free from radionuclidic impurities often found in $^{99m}$Tc obtained using alumina. 6 However, this procedure has not been investigated in as much detail as the chromatographic procedures and interest in this has been growing with the routine production of instant $^{99m}$Tc by several commercial suppliers. Even though it has been observed in practice that from alkaline solutions of $^{99}$Mo-molybdate, methyl ethyl ketone extracts $^{99m}$Tc-pertechnetate efficiently and yields a final product of medicinal purity, systematic data on the distribution of both $^{99m}$Tc and $^{99}$Mo into MEK from solutions of varying molybdate and sodium hydroxide concentrations have been lacking. $^{99m}$Tc obtained by MEK extraction procedure has been reported to give, at times, poor labelling yields in the preparation of various $^{99m}$Tc labelled radiopharmaceuticals, whereas $^{99m}$Tc obtained from alumina based generator give high labelling efficiency. 7, 8 Instant $^{99m}$Tc' samples supplied by commercial sources which are reportedly prepared by the MEK extraction procedure has been found to contain high levels of $^{99}$Mo impurity. 9 The possibility of methyl ethyl ketone, which comes into contact with concentrated alkali, forming aldol condensation products and their effect on the extractability and purity of $^{99m}$Tc have also not been studied. 10 The authors have studied here the