Background

B1 Water Problem in Jordan

Water supply reservoirs in Jordan (ground and surface water) will soon be exhausted and it is expected to suffer from water shortage in the near future, (Bannayan, 1991; National environment strategy for Jordan, 1991), (Tables 1.1 and 1.2.)

Table. B.1 Water resources in Jordan in Million m^3. (adopted from National environmental strategy for Jordan, 1991).

Year	1985		1989		1995		2005	
Resources	Available	Consumed	Available	Consumed	Available	Consumed	Available	Consumed
Renewable ground water.	280	313	280	375	280	359	280	390
Non Renewable ground water	118	25	118	56	118	118	118	118
Surface water	466	466	500	500	594	594	755	755
Treated waste water	20	20	32	32	60	60	60	60
Total	884	824	930	963	1052	1131	1213	1323

Table B.2. Water uses in Jordanian Million m^3. (adopted from National environmental strategy for Jordan, 1991).

Water uses	1985	1989	1995	2005
Domestically and industrial uses	200	242	254	301
Agricultural uses	624	721	877	1067
Total	824	963	1131	1368

The growing water consumption has exceeded all resources of the country for domestic, irrigation and industrial purposes, this is mainly as a consequence of its geographic climate (semiarid area); the high population growth rate (3,5%); continuously upgrading in the livings standard; and increasing in agricultural and industrial uses.

In Jordan many wastewater treatment plants have been built including: stabilisation ponds, trickling filters, activated sludge, mechanical oxidation ponds, rotating biological contactor (RBC), and combination of activated sludge and trickling filter (Gharaibeh and Rwajfih, 1989). More than 50% of wastewater is treated by stabilisation ponds, this is the

most natural wastewater treatment technique, because of low energy consumption, effectively and economically participle treatment process. The suitability of a pond's performance in Jordan is due to the availability of land with appropriate climatic factors (Temperature, sufficient of sunshine, wind, and low rainfall), (Gharaibeh and Rwajfih, 1989). Low pathogens and fecal organisms with nutrient rich effluents (Ammonium and Phosphor) can be obtained in this process (WHO, 1971).

However, the pollution of ground- and surface-water bodies with nitrate, ammonium, phosphate and heavy metals has increased. These contaminants originate from an incomplete treatment of domestic or industrial wastewater treatment plants or as a result of the treatment system itself (such as stabilisation ponds). This leads to polluted water reservoirs and as a resulting restricted and unsafe reuse for human beings. Eraifej and Abu-Jaber (1999) found that, a very high concentrations of nitrate has been observed in shallow ground water aquifers in NE Jordan (Mafraq area). They suggested the main pollution sources by nitrate are resulted from the effluents of Khirbet al Samra, but also the garbage dump in Akaider area and due to the agricultural activities in the area might be to have a big role on the pollution of the ground water aquifers.

From another environmental point of view, the solubility and leach-ability of ammonium and phosphor compounds from their fertiliser containing materials, are generally the principle sources for eutrophication phenomena, e.g. the King Talal dam in North Jordan (Salameh, 1987). Toxicity to fish and aquatic life from nitrate follows as a consequence and this leads to restricted uses of water reservoirs for man. Thus there is a great need for the use of environmentally friendly fertilisers (Slow release fertiliser technique).

B2 Aim of study.

This study concerns with uses of a low priced locally natural occurring zeolitic tuffs (brownish and reddish zeolitic tuffs) in environmental conservation, as ion exchangers and/or adsorbents, for the following main topics:

1. Characterisation of Jordanian zeolitic tuffs for their mineralogical- and chemical compositions, their cation exchange capacity (CEC), their thermal and acid resistance, their adsorption capacity and other technical properties..
2. Evaluation of Jordanian zeolitic tuffs as slow releasing fertiliser for ammonium and phosphor.
3. The selectivity of Jordanian zeolitic tuff for heavy metal ions (Pb^{2+}, Cd^{2+}, Cu^{2+}, Ni^{2+} and Zn^{2+}) from wastewaters.