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The PCB concentration in camel milk in Kazakhstan: Preliminary results

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Abstract

The potential of contamination by PCB is high in Kazakhstan due to the importance of sources of PCB in the country. However, in spite of this potential, the observed contaminations of food of animal origin for human consumption (milk and meat) appeared low. The data regarding camel milk could be explained by the specificity of the behavior of the camel (feeding behavior, breeding system, fat storage management (notably the role of the hump). A preliminary result regarding the kinetic of PCB in milk from two Bactrian camels contaminated over 56 days by PCB is reported in the present paper showing the relationship between quantity of PCB and fat excretion in milk.

The potential sources of PCB in Kazakhstan

In Kazakhstan, according to available information in 2012 [1] the PCB polluted areas are Ablaketka district and manufacturing plant of UKKP (Ust-Komenagorsk Condensator plant), Pond Drive UKKP, Substation of Ekibastuz, JSC "Pavlodar Chemical Plant", Derzhavinsk polygon destruction of military equipment, Polygon of Zhangiztobinsk destruction of military equipment, former military bases in northern Balkhash. In addition of that, based on thedata of Agency "Greenwomen" (2006) and analyzed production and industrial potential of the country the quantity of sources of PCB is reported [2] (table 1).

By considering the number of transformers and the number of targetlivestock (cattle, sheep and goat, horse and camel), the maximum risk for the two indicators are the Pavlodar and East Kazakhstan region (Figure 1). The main livestock regions in the country are: (i) South-Kazakhstan, Almaty, Zhambul and East-Kazakhstan for sheep (more than 2 000 ths heads), (ii) Almaty, South and East-Kazakhstan for cattle (more than 500 ths heads) and

horse (more than 200 ths heads), (iii). Southern-west part of Kazakhstan for camel [8].

Table 1 - Distribution of the main sources of PCB in Kazakhstan

Site	Source	Number
Semey nuclear test site	Capacitors	14,865
Pavlodar Chemical plant	Capacitors	31244
East-Kazakhstan oblast	Transformers	1
«	Capacitor pieces	1977
«	Capacitor installations	34
Karaganda oblast, Zhangiztobe polygon region	Transformers	105
«	Capacitors	1262
«	Capacitor installations	6
Aktobe oblast	Capacitors	520
West-Kazakhstan oblast	Capacitors	351
«	Capacitor installations	2
Mangistau region	Capacitors	323
Zhambyl oblast	Capacitors	290

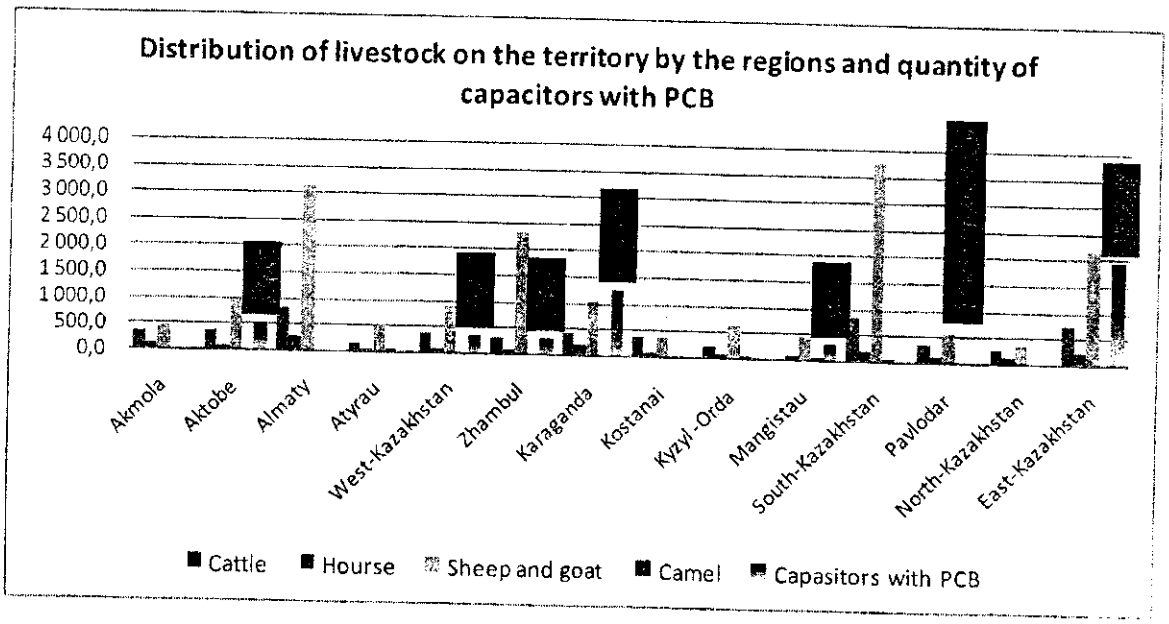

Figure 1 - Distribution of livestock on the territory by the regions and quantity of capacitors with PCB

PCB in animal food products in Kazakhstan

Despite this potential of pollution, PCB contamination of food produced byanimals in Kazakhstan appeared low according to the partial available published data. In a comparative study on the contamination of camel milk in Atyrau, Kyzylorda, Zhambul and South Kazakhstan oblasts, onlysamples from Kyzylorda oblast presented high level (0,95 ng/g) of PCB and mainly PCBs *52* and 138 [3]. Organic pollutants as PCBs being highly liposoluble, their presence in milk are linked to the fat which is in relative high proportion in camel milk in Kazakhstan (5,9-6,7%) [9]. In human breast milk from Almaty, Shymkent and two cotton growing area of South Kazakhstan Oblast (Djetisay and Kyrov), from the cities nearest of the Aral Sea (Aralsk and Kyzyl Orda), and from a site of petrochemical exploration on the Caspian Sea (Atyrau),the mean concentration of total PCBs was 410 ng/g fat. Concentrations of six PCB congeners(28, *52*, 101, 138, 153, 180) were reported between100 and 350 ng/g fat [4]. In Aral sea region, it was revealed that the PCBs was 1900 µg/kg in lipid of plasma of children, which was higher than in Europe [6]. PCDD/Fs in camel milk from Almaty, Atyrau, Aralsk, Shymkentwere investigated. The concentrations of PCDD/Fs were higher in the Atyrau oblast. This result could be linked with oil extraction in this region [7].

Regarding the low level of organic pollutants in camel milk in polluted areas mentioned above, three hypotheses could be advanced: 1) the moving of camels in a wide areas with low pollution pressure; 2) the specific prehensive behavior would make them less exposed to ingest pollutants via the soil, the main accumulation matrix; 3) a low efficiency to digest lipids and lipophilic compounds combined to a huge storage aptitude in the humps may lead to less excretion in milk [5].

PCB in camel milk: preliminary results

Nevertheless, the available data reported in the present paper, cannot support the understanding of the mechanisms of exposure and of detoxification. The assessment of contamination risk is not yet known in the situation of Kazakhstan. There is urgent need to achieve such studies for a convenient evaluation of the polluting impact for the human and animal population of the country. So, for understanding the ability of contamination and mechanisms of detoxification of camel by the kinetic of PCBs (polychlorinated biphenyls) in the milk, blood and hump fat tissues we did experiment with 4 lactating Bactrian Camels during 6 months. The main expected results are the definition of the dynamics of accumulation of PCBs in the milk, blood and hump fat tissues. We

expect to identify the target tissues of contaminants, and explain the mechanism of accumulation of pollutants in camels. The data of the research will help to calculate the effect of PCBs on human health, which consume camel milk in ecological territories. In such way it will be possible to make more detailed recommendations to consumers regarding the wide using of products of camel breeding in the population of Kazakhstan and other countries.

The preliminary results based on the monitoring of PCB content in two Bactrian camel milk for more than 4 months contaminated daily with 43.66 mg PCB per animal (1.3 µg/kg LW) for 56 days, underlined the important changes linked to the total fat. Indeed, the total PCB determined in milk (figure 2) appeared in close relationship with the total fat excreted in milk (figure 3).

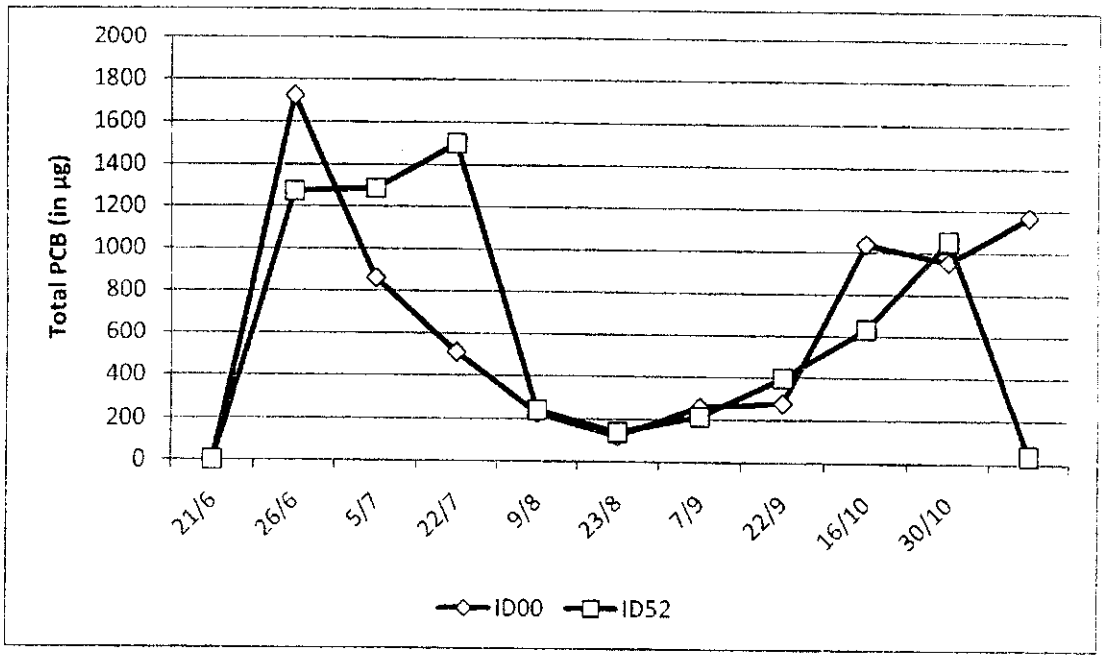

Figure 2 - Total PCB determined in two camel milk after 56 days of contamination (from 21/6 to 23/8)

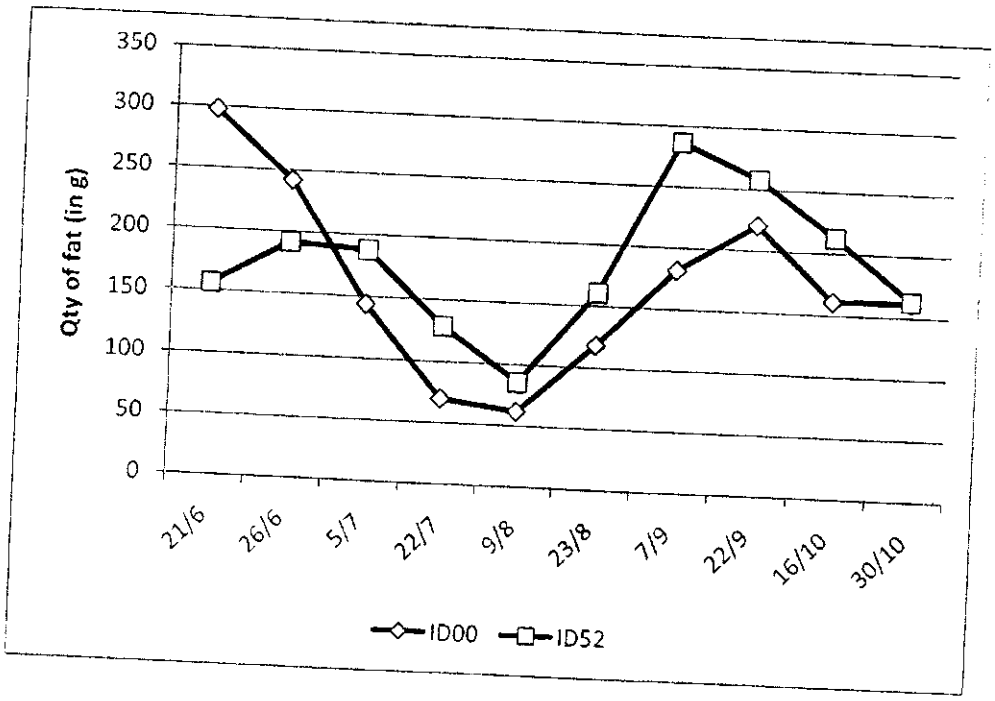

Figure 3 - Total quantity of fat excreted in two camel milk for more than four months

However, after the end of contamination (on 23 August), in spite of the increase in fat excretion, the quantity of PCB is less important than expected by the quantity of fat. To interpret the results, the analyses of quantity of PCB in hump fat has to be achieved.

However, these preliminary results are encouraging. The determination of total PCB present in fat storage (hump) will be the key-point to understand the kinetic of decontamination and the way of excretion of PCB through the milk.

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