

Aluminium Release from Aluminium Foil Containers into Food

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on request of

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I. Introduction

I.1. Aluminium in food

Many types of food contain natural levels of aluminium. The concentration in some products like tea, herbs, cocoa products and some spices may reach 10 mg/kg and higher. Food is the major source of aluminium exposure for the general population.

Aluminium used in food contact materials and articles usually contributes only small amounts to the exposure of consumers. However, if plain aluminium articles are brought into contact with acidic or very salty food chemical reactions of components of the food with the metallic aluminum may cause the formation of soluble aluminium salts, oxides and hydroxides which can be released into the food. A possible release of aluminium therefore occur due to corrosion rather than migration.

Plain aluminium articles therefore should not be used in contact with strongly acidic or very salty foodstuffs.

I.2. Safety of aluminium for dietary intake

The European Food safety Authority (EFSA) (Panel AFC) has published an *Opinion on the safety of aluminium for dietary intake* (1). Based on an evaluation of European exposure surveys and taking into account the available toxicological information regarding aluminium and aluminium compounds EFSA has established a tolerable weekly intake (TWI) for aluminium of 1 mg/kg bodyweight/week.

The Joint WHO/FAO Expert Committee on Food Additives (JECFA) has established a PTWI for aluminium of 2 mg/kg bodyweight/week (2).

I.3. Legal requirements for aluminium foil containers intended to come into contact with food

Within the EU there is no specific legal measure which covers metal and alloys intended to come into contact with food. In order to demonstrate compliance of metallic articles with the requirements of framework Regulation (EC) No. 1935/2004 (3) usually Resolution CM/Res (2013)9 of the Council of Europe (4) is applied. In conjunction with to CoE/EDQM *Technical guide on metals and alloys used in food contact materials and articles* this Resolution sets a specific release limit (SRL) for aluminium of 5 mg/kg.

In Italy there is a specific Ministry Decree for aluminium and aluminium alloy articles intended to come into contact with food (5). According to the Decree the purity of the applied aluminium and aluminium alloy is defined and has to be controlled for articles intended to come into contact with food.

I.4. Assessment of aluminium release by BfR

In 2017 the German Federal Institute for Risk Assessment (BfR) has published the results of a study on the release of aluminium from plain aluminium foil containers into food. (6) The BfR has filled three types of food (sauerkraut juice, diluted apple puree, liquid tomato puree) into three different types of plain aluminium foil containers at a temperature of 80 °C. The filled foil containers were cooled and stored for 72 hours under chilled conditions (3 °C). After storage the foil containers were heated to a core temperature of 72 °C and stored for 2 hours at 65 °C in order to simulate a typical cook & chill preparation of warm meals in communal feeding. The aluminium concentration in the prepared foodstuffs reached levels between 20 and 30 mg/kg.

The BfR concluded from their results that for regular consumers of communal feeding and out-of-home-catering there is a high risk to exceed the TWI of 1 mg/kg bodyweight/week recommended by EFSA. BfR therefore recommended to use internally coated aluminium foil containers instead of plain aluminium foil containers.

1.5. *Aim of the study*

It is the aim of this study to investigate the level of aluminium release which may occur under real conditions of use of plain aluminium foil containers in communal feeding. Different types of common aluminum foil containers for catering purposes shall be used in contact with a representative range of warm meals served as part of communal feeding. In order to reflect the impact of a realistic catering situation the meals shall be prepared and served in the aluminium foil containers under cook & chill conditions comparable to the set-up of the BfR study. The total aluminium content of the foodstuff after contact with the aluminium foil containers as well as the aluminium release from the foil containers into foodstuffs shall be measured. The aluminium exposure of consumers who regularly consume warm meals prepared and served in plain aluminium foil containers shall be evaluated.

II. **Samples and Test Procedure**

II.1. *Samples*

II.1.1. *Aluminium foil containers*

Six European aluminium foil container manufacturers provided from their regular production 16 different aluminium foil containers with one, two or three compartments intended to be used for ready-to-serve meals as part of communal feeding and out-of home catering.

Code	Supplier	Type	Format (cm)
1.1	A	1 compartment, plain	22 x 17 x 3
1.2	A	3 compartments, plain	22 x 17 x 3
2.1	B	1 compartment, plain	22 x 17 x 3
2.2	B	3 compartments, plain	22 x 17 x 3
2.3	B	1 comp., large, plain	32 x 25,5 x 5
3.1	C	1 compartment, internally and externally coated	16 x 11 x 3
4.1	A	1 comp., large, plain	32 x 25,5 x 5
5.1	D	1 compartment, plain	19 x 16 x 3
5.2.	D	3 compartments, plain	22 x 17 x 3
5.3	D	1 comp., large, plain	31 x 25,5 x 6
6.1	E	1 compartment, plain	22 x 17 x 4
6.2	E	3 compartments, plain	22 x 17 x 3
6.3	E	1 comp., large, plain	31 x 25,5 x 6
6.4	E	2 compartments, internally coated	22 x 17 x 4
7.1	F	1 compartment, plain	22 x 17 x 3
7.2	F	3 compartments, plain	22 x 17 x 3



Sample 1.1



Sample 1.2



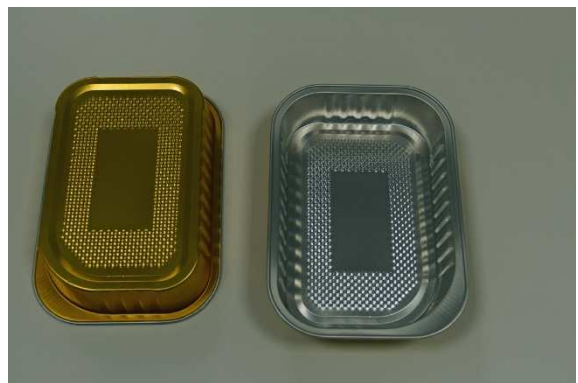
Sample 2.1



Sample 2.2



Sample 2.3



Sample 3.1



Sample 4.1



Sample 5.1



Sample 5.2



Sample 5.3



Sample 6.1



Sample 6.2



Sample 6.3



Sample 6.4



Sample 7.1



Sample 7.2

With regard to the limited capacity of the caterer the following aluminium foil containers were selected for the assessment:

sample 1.1
sample 1.2
sample 2.1
sample 2.2
sample 3.1
sample 4.1

The selection represents small foil containers with one and three compartments for single servings as well as large foil containers for multiple servings and internally coated aluminium foil containers.

II.1.2. Food samples

The preparation of the samples was carried out in cooperation with a commercial communal feeding company which is operating in a large German town.

The communal feeding caterer offers a daily changing variety of 7 types of warm and cold meals on 7 days of the week. There is a weekly change of the menu by the company. The meals are cooked and filled into plain aluminium foil containers in a central kitchen of the company. The meals are usually shipped in hot, ready-to-eat condition to customers which may keep the meals warm in circulating air ovens until consumption.

From the regular menu of the caterer for the 11th and 12th week 2018 those meals were selected which with regard to their type and components appeared to be most aggressive against aluminium. In total 20 meals which are usually served as a main course of the day were selected for preparation of the samples.

The net weight varied depending on the type of meal. It ranged between 180 g and 360 g for single serving foil containers. The multiple servings aluminium foil container was filled until the bottom of the foil containers was fully covered with food.

There were 3 foil containers of each type filled with each type of food. The multiple servings aluminium foil container was filled only with those types of food which reasonably could be prepared and served with such type of foil container, e.g. lasagne bolognese. There was only one samples of each type of food prepared in the large aluminium foil container.

One sample of each type of food was filled into a plastic container and was later on used as a blank in order to determine the natural aluminium content of the meal.

For the further assessment the filled foil containers were sealed with an aluminium foil lid and subsequently stored for 14 to 21 days at -22°C (+/- 5 °C) until further preparation and examination.



Picture: Filling and seaming of aluminium foil containers

The following meals have been selected from the menus:

No.	Day	Date	Category	Meal
1	MON	12.03.2018	III	Pork steak with pepper sauce and fried potatoes
2	TUE	13.03.2018	III	Lasagne Bolognese
3			VII	Bavarian sausage salad with pretzel roll*)
4	WED	14.03.2018	II	Fusili pasta with tomato sauce and fried sausage slice
5			III	Smoked spare ribs with sauce, beans and potatoes
6	THU	15.03.2018	VI	Vegetarian bell pepper with sauce and potatoes
7			V	Fried turkey breast with tomato basil sauce and potatoes
8	FRI	16.03.2018	II	Fried sausage with sauerkraut and potatoes
9			V	Diced pollack with vegetables and mustard dill sauce and potatoes
10	SAT	17.03.2018	II	Fried hering with onion rings and fried potatoes
11	SUN	18.03.2018	II	Boar goulash with forest mushrooms and potato dumplings
12	MON	19.03.2018	III	Knackwurst with sauerkraut and mashed potatoes
13			VI	Milk pasta with cinnamon and sugar, apple sauce
14	TUE	20.03.2018	I	Tomato rice soup with poultry meat balls
15			II	Beef with sauce, Brussel sprout, potatoes
16	WED	21.03.2018	II	Makkaroni pasta with sausage goulash
17			III	Kasseler steak with honey mustard sauce, Romanesco broccoli and potatoes
18	THU	22.03.2018	I	Gyros soup with white bread
19			III	Curry sausage pan (sausage slices with tomato curry sauce) with mashed potatoes
20	FRI	23.03.2018	II	Turkey ragout "hunters type" with potatoes

*) This meal was heated in order to achieve comparable test conditions although it is typically served cold.

Categories of meals:

I = "Eintöpfe" (stews)
II = "Hausmannskost" (home cooking)
III = "Das Pikante" (savory meals)
IV = "Das Kleine" (small dishes)
V = "Bekömmliche Kost" (wholesome meals)
VI = "Vegetarisch" (vegetarian)
VII = „Kaltgericht“ (cold meal)

II.2. Test procedure

II.2.1 Sample preparation

Prior examination the frozen meals were kept for 12 hours at 7 °C (+/- 2 °C) in order to become molten. The samples were heated in a circulating air oven at 150 °C for 50 minutes in order to reach a center temperature of at least 70 °C (preparation of a ready-to-serve condition). Afterwards the meals were kept in an oven for 2 hours at 65 °C in order to simulate a typical catering condition (keeping warm in a ready-to-serve condition).

The blank samples were not heated and kept warm after cold storage.

II.2.2 Homogenisation and digestion

After sample preparation the contents of three similar sample foil containers was combined and homogenized. An aliquot portion of the homogenized samples was digested in concentrated nitric acid using a microwave digestion system.

II.2.3 Determination of aluminium in the food

The aluminium concentration was measured by an ICP/MS procedure. The LOQ (limit of quantification) of the procedure was 0,02 mg/kg.

Digestion and determination of the aluminium concentration were carried out according to procedure ASU §64 LFGB L 00.00-157 (official collection of test procedures according to § 64 of the German Law on Food and Feed). (7)

The margin of deviation of the determination of aluminium in the food samples is ca. $\pm 0,2$ mg/kg.

Sample preparation, homogenisation, digestion and Al measurement were carried out by an independent contract laboratory accredited according to DIN EN ISO/IEC 17025.

II.2.4 Evaluation

The test results are expressed as the total aluminium content of the samples (mg/kg) as well as the aluminium release (mg/kg) which was calculated by subtracting the total aluminium content of the respective blank from the total aluminium content of the sample. In case where the sum is <0,1 mg/kg or due to the deviation of the determination of aluminum even a negative figure the aluminium release was expressed as "<0,1 mg/kg".

III. Test results**III.1. Aluminium foil container 1.1**

Aluminium foil container 1.1: one compartment, plain

No.	Meal	Container 1.1	Blank	Container 1.1
		Total Aluminium content		Aluminium release
		Al (mg/kg)	Al (mg/kg)	Al (mg/kg)
1	III Pork steak with pepper sauce and fried potatoes	1,0	0,2	0,8
2	III Lasagne Bolognese	5,1	4,2	0,9
3	VII Bavarian sausage salad with pretzel roll	4,7	1,5	3,2
4	II Fusili pasta with tomato sauce and fried sausage slice	3,6	1,6	2,0
5	III Smoked spare ribs with sauce, beans and potatoes	2,2	0,7	1,5
6	VI Vegetarian bell pepper with sauce and potatoes	3,4	2,2	1,2
7	V Fried turkey breast with tomato basil sauce and potatoes	3,0	1,2	1,8
8	II fried sausage with sauerkraut and potatoes	1,5	0,5	1,0
9	V Diced pollack with vegetables and mustard dill sauce and potatoes	1,0	0,4	0,6
10	II Fried hering with onion rings and fried potatoes	5,3	0,9	4,4
11	II Boar goulash with forest mushrooms and potato dumplings	2,8	1,2	1,6
12	III Knackwurst with sauerkraut and mashed potatoes	2,0	n.d. (<0,2)	2,0
13	VI Milk pasta with cinnamon and sugar, apple sauce	4,0	0,4	3,6
14	I Tomato rice soup with poultry meat balls	5,4	3,2	2,2
15	II Beef with sauce, Brussel sprout, potatoes	1,9	0,7	1,2
16	II Makkaroni pasta with sausage goulash	2,8	0,9	1,9
17	III Kasseler steak with honey mustard sauce, Romanesco broccoli and potatoes	0,3	0,2	0,1
18	I Gyros soup with white bread	4,5	2,5	2,0
19	III Curry sausage pan (sausage slices with tomato curry sauce) with mashed potatoes	3,5	1,6	1,9
20	II Turkey ragout "hunters type" with potatoes	1,2	0,5	0,7

n.d. = not detectable, below LOQ (<0,2 mg/kg)

III.2. Aluminium foil container 1.2

Aluminium foil container 1.2: three compartments, plain

No.	Meal	Container 1.2	Blank	Container 1.2
		Total Aluminium content		Aluminium release
		Al (mg/kg)	Al (mg/kg)	Al (mg/kg)
1	III Pork steak with pepper sauce and fried potatoes	0,9	0,2	0,7
2	III Lasagne Bolognese		4,2	
3	VII Bavarian sausage salad with pretzel roll		1,5	
4	II Fusili pasta with tomato sauce and fried sausage slice		1,6	
5	III Smoked spare ribs with sauce, beans and potatoes	1,5	0,7	0,8
6	VI Vegetarian bell pepper with sauce and potatoes	2,7	2,2	0,5
7	V Fried turkey breast with tomato basil sauce and potatoes	2,4	1,2	1,2
8	II fried sausage with sauerkraut and potatoes	1,0	0,5	0,5
9	V Diced pollack with vegetables and mustard dill sauce and potatoes	0,4	0,4	<0,1
10	II Fried hering with onion rings and fried potatoes	2,2	0,9	1,3
11	II Boar goulash with forest mushrooms and potato dumplings	2,3	1,2	1,1
12	III Knackwurst with sauerkraut and mashed potatoes	2,1	n.d. (<0,2)	2,1
13	VI Milk pasta with cinnamon and sugar, apple sauce	1,8	0,4	1,4
14	I Tomato rice soup with poultry meat balls		3,2	
15	II Beef with sauce, Brussel sprout, potatoes	1,4	0,7	0,7
16	II Makkaroni pasta with sausage goulash		0,9	
17	III Kasseler steak with honey mustard sauce, Romanesco broccoli and potatoes	0,7	0,2	0,5
18	I Gyros soup with white bread		2,5	
19	III Curry sausage pan (sausage slices with tomato curry sauce) with mashed potatoes	4,3	1,6	2,7
20	II Turkey ragout "hunters type" with potatoes	0,9	0,5	0,4

n.d. = not detectable, below LOQ (<0,2 mg/kg)

III.3. Aluminium foil container 2.1

Aluminium foil container 2.1: one compartment, plain

No.	Meal	Container 2.1	Blank	Container 2.1
		Total Aluminium content		Aluminium release
		Al (mg/kg)	Al (mg/kg)	Al (mg/kg)
1	III Pork steak with pepper sauce and fried potatoes	1,3	0,2	1,1
2	III Lasagne Bolognese	5,5	4,2	1,3
3	VII Bavarian sausage salad with pretzel roll	12,2	1,5	10,7
4	II Fusili pasta with tomato sauce and fried sausage slice	6,8	1,6	5,2
5	III Smoked spare ribs with sauce, beans and potatoes	2,9	0,7	2,2
6	VI Vegetarian bell pepper with sauce and potatoes	2,9	2,2	0,7
7	V Fried turkey breast with tomato basil sauce and potatoes	11,7	1,2	10,5
8	II fried sausage with sauerkraut and potatoes	1,1	0,5	0,6
9	V Diced pollack with vegetables and mustard dill sauce and potatoes	1,1	0,4	0,7
10	II Fried hering with onion rings and fried potatoes	5,8	0,9	4,9
11	II Boar goulash with forest mushrooms and potato dumplings	1,9	1,2	0,7
12	III Knackwurst with sauerkraut and mashed potatoes	5,0	n.d. (<0,2)	5,0
13	VI Milk pasta with cinnamon and sugar, apple sauce	5,2	0,4	4,8
14	I Tomato rice soup with poultry meat balls	17,6	3,2	14,4
15	II Beef with sauce, Brussel sprout, potatoes	1,6	0,7	0,9
16	II Makkaroni pasta with sausage goulash	1,9	0,9	1,0
17	III Kasseler steak with honey mustard sauce, Romanesco broccoli and potatoes	0,8	0,2	0,6
18	I Gyros soup with white bread	3,5	2,5	1,0
19	III Curry sausage pan (sausage slices with tomato curry sauce) with mashed potatoes	7,1	1,6	4,5
20	II Turkey ragout "hunters type" with potatoes	1,3	0,5	0,8

n.d. = not detectable, below LOQ (<0,2 mg/kg)

III.4. Aluminium foil container 2.2

Aluminium foil container 2.2: three compartments, plain

No.	Meal	Container 2.2	Blank	Container 2.2
		Total Aluminium content		Aluminium release
		Al (mg/kg)	Al (mg/kg)	Al (mg/kg)
1	III Pork steak with pepper sauce and fried potatoes	1,1	0,2	0,9
2	III Lasagne Bolognese		4,2	
3	VII Bavarian sausage salad with pretzel roll		1,5	
4	II Fusili pasta with tomato sauce and fried sausage slice		1,6	
5	III Smoked spare ribs with sauce, beans and potatoes	1,5	0,7	0,8
6	VI Vegetarian bell pepper with sauce and potatoes	2,7	2,2	0,5
7	V Fried turkey breast with tomato basil sauce and potatoes	2,9	1,2	1,7
8	II fried sausage with sauerkraut and potatoes	1,0	0,5	0,5
9	V Diced pollack with vegetables and mustard dill sauce and potatoes	0,6	0,4	0,2
10	II Fried hering with onion rings and fried potatoes	5,0	0,9	4,1
11	II Boar goulash with forest mushrooms and potato dumplings	2,9	1,2	1,7
12	III Knackwurst with sauerkraut and mashed potatoes	1,1	n.d. (<0,2)	1,1
13	VI Milk pasta with cinnamon and sugar, apple sauce	2,1	0,4	1,7
14	I Tomato rice soup with poultry meat balls		3,2	
15	II Beef with sauce, Brussel sprout, potatoes	1,4	0,7	0,7
16	II Makkaroni pasta with sausage goulash		0,9	
17	III Kasseler steak with honey mustard sauce, Romanesco broccoli and potatoes	0,8	0,2	0,6
18	I Gyros soup with white bread		2,5	
19	III Curry sausage pan (sausage slices with tomato curry sauce) with mashed potatoes	3,3	1,6	1,7
20	II Turkey ragout "hunters type" with potatoes	0,8	0,5	0,3

n.d. = not detectable, below LOQ (<0,2 mg/kg)

III.5. Aluminium foil container 3.1

Aluminium foil container 3.1: one compartment, internally coated

No.	Meal	Container 3.1	Blank	Container 3.1
		Total Aluminium content		Aluminium release
		Al (mg/kg)	Al (mg/kg)	Al (mg/kg)
1	III Pork steak with pepper sauce and fried potatoes	0,3	0,2	0,1
2	III Lasagne Bolognese	4,1	4,2	<0,1
3	VII Bavarian sausage salad with pretzel roll	1,2	1,5	<0,1
4	II Fusili pasta with tomato sauce and fried sausage slice	2,0	1,6	0,4
5	III Smoked spare ribs with sauce, beans and potatoes	0,8	0,7	0,1
6	VI Vegetarian bell pepper with sauce and potatoes	1,8	2,2	<0,1
7	V Fried turkey breast with tomato basil sauce and potatoes	1,3	1,2	0,1
8	II fried sausage with sauerkraut and potatoes	0,5	0,5	0,1
9	V Diced pollack with vegetables and mustard dill sauce and potatoes	0,4	0,4	<0,1
10	II Fried hering with onion rings and fried potatoes	0,8	0,9	<0,1
11	II Boar goulash with forest mushrooms and potato dumplings	1,3	1,2	0,1
12	III Knackwurst with sauerkraut and mashed potatoes	n.d.(<0,2)	n.d. (<0,2)	n.d.(<0,2)
13	VI Milk pasta with cinnamon and sugar, apple sauce	0,6	0,4	0,2
14	I Tomato rice soup with poultry meat balls	2,9	3,2	<0,1
15	II Beef with sauce, Brussel sprout, potatoes	0,6	0,7	<0,1
16	II Makkaroni pasta with sausage goulash	1,1	0,9	0,2
17	III Kasseler steak with honey mustard sauce, Romanesco broccoli and potatoes	0,2	0,2	<0,1
18	I Gyros soup with white bread	2,9	2,5	0,4
19	III Curry sausage pan (sausage slices with tomato curry sauce) with mashed potatoes	2,7	1,6	1,1
20	II Turkey ragout "hunters type" with potatoes	0,5	0,5	<0,1

n.d. = not detectable, below LOQ (<0,2 mg/kg)

III.6. Aluminium foil container 4.1

Aluminium foil container 4.1: multiple servings foil container, one compartment, plain

No.	Meal	Container 4.1	Blank	Container 4.1
		Total Aluminium content		Aluminium release
		Al (mg/kg)	Al (mg/kg)	Al (mg/kg)
1	III Pork steak with pepper sauce and fried potatoes		0,2	
2	III Lasagne Bolognese	4,9	4,2	0,7
3	VII Bavarian sausage salad with pretzel roll		1,5	
4	II Fusili pasta with tomato sauce and fried sausage slice	2,7	1,6	1,1
5	III Smoked spare ribs with sauce, beans and potatoes		0,7	
6	VI Vegetarian bell pepper with sauce and potatoes		2,2	
7	V Fried turkey breast with tomato basil sauce and potatoes		1,2	
8	II fried sausage with sauerkraut and potatoes		0,5	
9	V Diced pollack with vegetables and mustard dill sauce and potatoes		0,4	
10	II Fried hering with onion rings and fried potatoes		0,9	
11	II Boar goulash with forest mushrooms and potato dumplings		1,2	
12	III Knackwurst with sauerkraut and mashed potatoes		n.d. (<0,2)	
13	VI Milk pasta with cinnamon and sugar, apple sauce		0,4	
14	I Tomato rice soup with poultry meat balls		3,2	
15	II Beef with sauce, Brussel sprout, potatoes		0,7	
16	II Makkaroni pasta with sausage goulash	1,4	0,9	0,5
17	III Kasseler steak with honey mustard sauce, Romanesco broccoli and potatoes		0,2	
18	I Gyros soup with white bread		2,5	
19	III Curry sausage pan (sausage slices with tomato curry sauce) with mashed potatoes		1,6	
20	II Turkey ragout "hunters type" with potatoes		0,5	

n.d. = not detectable, below LOQ (<0,2 mg/kg)

IV. Summary and conclusions

A range of 20 cooked meals selected from the regular menu of a German communal feeding caterer were filled into 6 different selected aluminium foil containers, stored under chilled conditions and prepared for consumption using cook & chill conditions. The release of aluminium from the plain and coated aluminium foil containers into food was determined.

The selection of tested samples of aluminium foil containers is representative for products on the market commonly used for catering purposes.

The selection of tested food samples represents a common variety of warm meals served as main courses of the day by a German catering service. Because the most corrosive types of food were selected from the menu the selection may be regarded as a worst case of a diet consumed by typical regular consumers of communal feeding, e.g. children in kindergardens, children at school, employees using company canteens and elder people.

The selected conditions of sample preparation represent worst case conditions as they may occur during the preparation and distribution of communal feeding which is in conformity with standard DIN 10536:2016-02 (food hygiene – cook & chill procedure). (8)

Therefore the tests results are suitable to estimate the average intake of aluminium by consumers who regularly consume warm meals served in plain aluminium foil containers as part of communal feeding.

According to the results of the assessment the release of aluminium from plain aluminium foil containers into cooked foodstuff served as a main course stays usually well below the specific release limit (SRL) of 5 mg/kg according to Council of Europe Resolution CM/Res (2013)9.

There were only three exemptions where a release of aluminium exceeded the SRL. The high levels of aluminium release occurred only for very corrosive types of food filled into one particular type of plain aluminium foil container (foil container 2.1).

The average aluminium release from plain aluminium foil containers into food was 2,0 mg/kg with minimum values of <0,1 mg/kg and a maximum value of 14,4 mg/kg.

The average aluminium release from plain aluminium foil containers excluding foil container no. 2.1 into food was 1,3 mg/kg with minimum values of <0,1 mg/kg and a maximum value of 4,1 mg/kg.

Under applied test conditions there is only a minor aluminium release from internally coated aluminium foil containers into food. The highest aluminium release from a coated aluminium foil container was 1,1 mg/kg, the average aluminium release from the internally coated foil container into food was 0,2 mg/kg.

IV.1 Test results exceeding the SRL

In three cases the SRL for aluminium of 5 mg/kg was significantly exceeded. The highest release of aluminium was 14,4 mg/kg.

The high levels of aluminium release were detected only for one type of plain aluminium foil container (foil container 2.1, one compartment) when it came into contact with most aggressive foodstuffs (sausage salad with a vinegar based brine, tomato sauce and tomato soup).

The comparable sample of plain aluminium foil containers provided by another supplier (foil container 1.1) did not show excessive aluminium release when it was in contact with the same type of rather aggressive foodstuffs.

High results for aluminium release correlate with visible corrosion defects on the internal surface of the aluminium foil containers.

Further investigations are needed in order to identify the reasons for different corrosion stability of the aluminium foil containers.

Foil container type no. 2.1 has to be evaluated as not suitable for the use in contact with even low acidic foodstuffs as they may occur in the regular menu of communal feeding caterers.



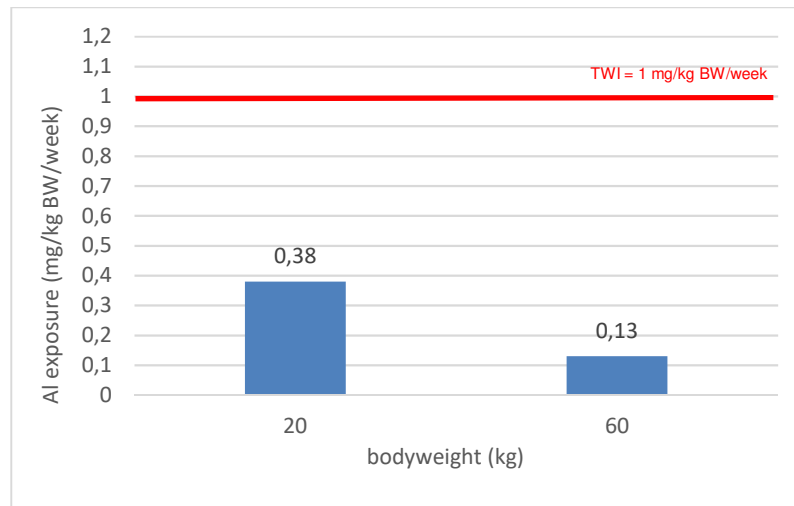
Picture: Foil containers after contact with foodstuff sample no.14: foil container 1.1. (left) no visible corrosion defects and foil container 2.1 (right) with corroded internal surface

IV.2 Exposure of consumers

According to the results of the assessment the average total aluminum content of prepared meals packed and prepared in plain aluminium foil containers was 3,1 mg/kg. This average value includes also those cases where the SRL of 5 mg/kg was exceeded.

There is an increasing group of consumers who regularly eat warm meals provided by communal feeding. Taking into account a daily consumption of one warm meal with an average net weight of 350 g served in a plain aluminium container with regard to the results of the assessment a daily intake of 1,1 mg aluminium per person and a weekly intake of 7,7 mg aluminium per person can be calculated.

The weekly aluminium exposure by warm meals served in plain aluminium containers would be 0,38 mg/kg bodyweight/week for children with a body weight of 20 kg and 0,13 mg/kg bodyweight/week for adults with a body weight of 60 kg. The exhaust of the tolerable weekly intake (TWI) recommended by EFSA of 1 mg/kg bodyweight/week by warm meals served in plain aluminium containers is therefore 38 % for children with a bodyweight of 20 kg and 13 % for adults with a bodyweight of 60 kg.



Picture: Weekly Al exposure for children and adults by regular consumption of warm meals served in plain aluminium containers

IV.3 Comparison with results published by German BfR

The results of this rather excessive study do not confirm the findings published on 2017 by the German BfR.

- The release of aluminium from plain aluminium foil containers into real food under cook & chill conditions does usually not exceed the SRL of 5 mg/kg. Values detected by BfR in unrealistic food like sauerkraut juice, diluted apple puree and liquid tomato puree ranged between 20 and 30 mg/kg and obviously do not reflect the situation as it occurs under real conditions of communal feeding.
- The results of this study do not confirm the findings of the German BfR with regard to the differences between plain aluminium foil containers with one and those with three compartments. Plain aluminium foil containers with three compartments when used under real conditions do not show a higher aluminium release than plain foil containers with only one compartment.
- In order to reduce the exposure of consumers with aluminium based on their unrealistic findings the German BfR recommended to use coated aluminium foil containers rather than plain aluminium foil containers. According to the results of this study regular consumption of communal feeding prepared and served in plain aluminium foil containers under cook & chill conditions does not cause a high contribution to the total aluminium exposure even of sensible consumers such as children. The results do not indicate the need to replace plain aluminium foil containers.

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