018530 - SWITCH

Sustainable Water Management in the City of the Future

Integrated Project
Global Change and Ecosystems

Deliverable 5.2.4 - Annex 3

Identification of potential pharmaceutical residues present in urine samples collected from a public urinary located within the market adjacent to Novotel Hotel, Accra

Due date of deliverable:
Actual submission date:

Start date of project: 1 February 2006 Duration: 63 months

Organisation name and lead contractor for this deliverable: IWMI (Collins Tay)

Revision [final]

Project co-funded by the European Commission within the Sixth Framework Programme (2006-2011)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

5.2.4 Action Research and Demonstrations on the Use of Water for Urban Agriculture
Work package 5.2

The aim of work package 5.2 is to contribute to a paradigm shift in wastewater management and sanitation towards a recycling-oriented closed loop approach. The work package is being implemented in three cities; Accra, Beijing and Lima, and includes the identification and integration of appropriate productive re-use of urban freshwater, storm and waste-water for agriculture into the policy and planning frameworks of these cities.

The deliverables of the work package follow a sequence of implementation. Based on a situation and stakeholder review (del. 5.2.1), working groups are formed, meet and are linked to the Learning alliances (del. 5.2.2), they receive training in multi-stakeholder action planning (del. 5.2.3 A), and are involved in, and informed on, specific research by consultants, MSc and PhD or action research linked to the demonstrations, (all under del. 5.2.4). Information has been disseminated in publications, magazines and newsletters (del. 5.2.5), and guidelines and related training material has been developed (del 5.2.3 B and C). The leading institutes here are ETC (WP coordinator), IWMI (Accra), IGSNRR (Beijing) and IPES (Lima), other institutions involved were WUR, IRC and NRI- GUEL.

As part of deliverable 5.2.4, this product contains information on the demonstration on the use of urine as an alternative fertilizer.
Contributing products included in this document are:

5.2.4 Ad1 Demonstration Proposal Demonstration on the use of urine as an alternative fertilizer in urban agriculture.
5.2.4 Ad2 Full Report, Olufunke Cofie, Philip Amoah, Irene Eygir, Noah Adamtey, Frederick Tettey Lowor. 2011. IWMI-: “Demonstration on the Use of Urine in Urban Agriculture in Accra, Ghana”.

5.2.4 Ad3 MSc Thesis (Briefing Sheet): Mark Kwame Ofei, University Ghana: "Financial feasibility of urine use for agriculture in Accra".
5.2.4 Ad4 MSc Thesis (Briefing Sheet): Patrick Koomson, University Ghana: "Perception and willingness to pay for urine in Accra, Ghana:
The Full MSc reports is listed under PhD and MSc reports, theme 5

5.2.4 Ad5 Identification of Potential Pharmaceutical Residues Present in Urine Samples Collected from a Public Urinary Located Within the Market Adjacent Novotel Hotel, Accra. MSc, Collins Tay, CSIR Water Research Institute, Accra. 2010.
Report on Training See deliverable 5.2.3;

SWITCH DEMONSTRATION PROJECT

1. Name of Demonstration:	**2. Location(s):**
Demonstration on the use of urine as an alternative fertilizer in urban agriculture	Dzorwulu, Accra

3. Lead workpackages/partners:

5.2 Urban Agriculture: IWMI-Ghana (O.COFIE@CGIAR.ORG) and ETC-Leusden (r.van.veenhuizen@etcnl.nl)

4.1 Decentralised wastewater management: Wageningen University (*adriaan.mels@wur.nl)*

Other work packages involved:
6.3 – social inclusion: KNUST (berthadarteh@yahoo.co.uk), NRI (a.m.martin@gre.ac.uk) and IRC (verhagen@Irc.nl)

4. Timeframe:

January 2009 – January 2011

5. Description of demonstration:

Background:
Accra like most cities in the developing world is experiencing rapid population growth and urbanization. This rapid urbanization has brought about urban poverty, food insecurity and severe environmental degradation. Urban agriculture is nowadays a predominate feature within the urban ecological system. It is estimated that up to 90% of the city's fresh vegetable consumption is from production within the city (Cencosad 1994, Drechsel et al 2006).
Extensive urban agriculture takes place on 7 main sites in Accra. There are about 1000 vegetable farmers as well other farmers who are engaged in some seasonal crops such as maize and cassava. In addition to this, a considerable number of households are engaged in backyard gardening. As at 2004, it was estimated that about 17 ha of land was under cultivation for maize, 20 ha under cultivation for pepper, 104 ha under cultivation for okro and 14 ha under cultivation of tomatoes (Obuobie et al, 2006, Cofie et al 2006). To maintain soil fertility under such intensive system, the farmers often use poultry manure and chemical fertilizer. The high cost of mineral fertilizers is a constraint to farming activities in the city. Hence availability of alternative sources of nutrient will enhance the productivity of urban agriculture.

Meanwhile 95% of the city's populace uses on site sanitation facilities (public toilet, bucket latrines, septic tanks) as the main means of sanitation making these places a potential source of nutrients and organic matter production for urban agriculture in Accra in the form of human excreta and urine. Public toilets are common, especially in the highly densely populated marginalized areas. Close to a third of the city's households have no toilets in their homes and they therefore rely on public. Furthermore, there are public urinals which are located within some of the densely populated residential areas and public places such as bus stations, markets and restaurants. Most of the urinals and public toilets that are located within and around the city centre are privately owned and are pay to use.

Proper liquid waste collection and management technologies are generally absent in most public urinal facilities. The initial agreement between the Waste Management Department and the entrepreneur who has the franchise to operate the urinals was that, the urine generated from these urinals should be collected and disposed off at one of the waste disposal sites of the AMA. Unfortunately this agreement has not been adhered to. Consequently all the urine that comes from these urinals are discharged directly into the drains and consequently into the Korle lagoon untreated thereby seriously polluting this water body.
A study carried out (Cofie et al 2007) on 14 of these urinals which are located within the Central Business

District revealed that 7.3 m^3 of urine is generated per day. This is approximately 2.2 thousand m^3 of urine per year. In terms of nitrogen alone this volume represents 6.6 tonnes of plant available nitrogen.

By harvesting and using urine for urban agriculture, a win-win situation can be achieved. A relief can then be achieved for the urinal entrepreneur who is thinking about where to dump his waste. The city authorities will also be relieved of the burden of the pollution that the current urine discharge is causing and so is the urban farmer who is also thinking about a reliable and cheaper fertilizer source.

A recent research by Frederick Tettey-Lower (2008) has shown that, the socio-technical regime is warm for the described innovation as those in the urban agricultural sector are looking for an alternative fertilizer as a result of the high cost of the mineral fertilizers. On the other hand, the regime of urban sanitation is also looking for a logical means of waste disposal and they see the agricultural sector as a likely end user.
This demos is closely related to the demo on on-farm wastewater treatment which is being implemented at the same site

Objective of the demonstration project:
The project aims to demonstrate the potential of the use of human urine as fertilizer in urban agriculture. This will on the one side provide a new, cheap fertilizer to the farmers, while at the same time reduce the emissions of nutrients to the urban drainage system and ultimately to the Korle lagoon. The value of human urine as nutrient is well known and its application has been advocated on many platforms on sustainable sanitation worldwide. However, the experience with Ecosan in Accra is limited despite the potential for its success.

Project description:
The project involves the adoption of existing urinals within the Central Business District of Accra. These urinals will be adapted to make urine collection possible by using - mainly - local materials and expertise wherever possible. It will also involve a training stage where urinal operators will be trained in the maintenance of the facility so as not to destroy the natural treatment processes that go on in the harvested urine. Additionally an entrepreneur will be identified and empowered to deal in the transport of urine from the urinals to the farm). This approach will make it easier for the technology to be exploited by urinal operators within the city thereby contributing to a healthy environment and a reduction of the level of pollution in the Korle lagoon.

The urine so collected will be used for demonstration purposes as an alternative fertilizer on one of the urban farming sites in Dzorwulu. The demonstration project will run for a period of two years. It will demonstrate to the farmers the right use of urine application and also a comparative analysis in the increase in yield of crops fertilized with urine as compared to chemical fertilizer, poultry manure and crops not fertilized at all.

***Innovative features/science**:*
The innovation in this demonstration project lies in the integration of two sectors, the valorization of a compound that is considered a waste and the consequent reduction of pollution. The use of urine in urban agriculture will provide an alternative fertilizer and induce a higher crop yield to farmers. The use as a fertilizer will create incentives to store and use the urine instead of discharging it into the drains provides an option to reduce the level of pollution in the Korle lagoon.

Other features that are innovative to the local situation are:

- The collection of urine in holding tanks instead of discharging them into the drains
- The adaptation or installation of urinals which will use little or no water at all and which do not smell.
- The use of an environmentally friendly detergent in the cleaning of the urinals as compared to the toxic type currently being used
- The identification of an entrepreneur who will be involved in the transportation of the urine from the urinal to the farm.
- The reuse of urine for urban agriculture which will provide a cheaper alternative fertilizer and

induce a higher crop yield.

The scientific significance related to this research is:

- A research into the economic feasibility of the system from the separation of the urine up to the application on the field.
- A cost-benefit analysis of the operating the system: urine use in farms, diversion from polluting the environment
- stakeholders perception study
- Identify the potential drivers and barriers for large scale implementation of urine harvesting and reuse. The research will make use of the theories of transitional management
- A demonstration and research component into the application of urine as a fertilizer in urban agriculture.

Potential impact:

If the demonstration project is successful and accepted by stakeholders and upscale to the city level, it has the potential to impact various aspects of the society:

Environmental impact: the nutrient load particularly on the Korle lagoon (which receives most of the municipal wastewater from the city) will be reduced drastically. Currently most of the municipal wastewater from Accra enters this water body untreated through the Odaw River. Several studies have shown that up to 80% of the total N load, and around 45% of the total P load in municipal wastewater originates from urine.(Ref?) A separation of urine therefore will improve the quality of this water body and reduce eutrophication.

Socio-Economic impact: farmers, private entrepreneurs and municipal authorities would benefit from the intervention. The approach will cater for a new type of fertilizer. Urine application can increase crop yield between 2 to 6 times more than crops not fertilized at all. This will improve the crop yield of the farmers and increase their income, hence improve livelihood. Furthermore, the project will also provide employment for those who will be engaged in transporting the urine.

Health impact: there would also be positive impact on the public health from reduction in pollution and odour nuisance from indiscrimate disposal of urine

Beyond Accra, this success of this intervention can be taken up across sub-Saharan Africa and other developing nations.

Relationship to LA – evidence of demand:

Ecological sanitation was one of the issues coming up out of the visioning workshop in August 2007. City stakeholders are very interested in reducing pollution burden due to poor sanitation. In the vision, By 2030, *Accra should have 50-80% of waste recycled*

The proposed demo would contribute to achieving this goal

Plans/ideas for scaling up:

Several institutions have direct or indirect stake in the demo topic. In Accra, detailed stakeholder analysis has been done by the SWITCH LA and other related projects such as the RUAF program of IWMI and the TPP program of TREND/IRC. Therefore the demo will benefit from the existing platforms and involve relevant stakeholders within the SWITCH LA in demo implementation. The following specific stakeholders within the LA will be involved in the appropriate demo component that relate to their mandate area. the demonstration project for These stakeholders have some interest either directly or indirectly in urban agriculture. Their involvement will therefore bring about a market for the urine, a possible change of attitude towards the use of urine, the formulation of policies regarding the separation and collection of urine and education of the citizens in relation to the safety of crops fertilized with urine. This will encourage places where large volumes of urine are generated such as drinking bars, schools and other like institutions to

harvest urine for possible sale.

It is intended that a number of key persons / institutions will be involved in the current Learning Alliance. Once the demonstration project starts and becomes successful the technology will be transferred to other urban farming sites and then to the peri-urban agricultural centres

STAKEHOLDERS	ROLE
GOVERNMENT AGENCIES	
Metro Directorate of Food and Agriculture	Involved in field experimentation and holistic Extension services to ensure the success and sustainability of the intervention. It is also anticipated that thereafter, MoFA will be able to integrate urine use in their overall institutional strategy
Metropolitan Environment and Health Unit	As discussion partners and regulatory agency especially in the harvesting of urine and maintenance of urinals
Waste Management Department	Assist to supervisor and implement urine collection and transport for disposal (at farm site)
Environmental Protection Agency	Discussion partner
Food and Drugs Board / Standard Board	Discussion partner (so far not in the SWITCH LA but will be informed) especially on produce quality and standardization.
RESEARCH INSTITUTIONS	
IWMI	Lead the research in urban agriculture and agricultural water management; Brings demo intervention in the context of overall urban agriculture and urban water management for the city of Accra.
CSIR-WRI	For Urine quality analysis
KNUST/UG	Student supervision; link with related work on application of excreata- based fertilizer in the demos site
Valley View University	Discussion partner. To link their existing work on ecosan to demo intervention
LOCAL ASSOCIATIONS	
Dzorwulu farmers Association	Co- implementers; provide farm land and farming support
Market women	for post harvest handling of urine cultivated produce
ENTREPRENEURS	
urinal operators	Maintenance of urinals and harvest of urine
Safi Sana ltd	Transportation of the urine
OTHERS	
Existing Networks and Programs: AWGUPA, TPP, WashCost, RCN, LA	For sharing of Information, sysnergies with related programms

6. Budget Summary (overall description of SWITCH and match funding – how 35/65% split will be achieved)

Year	*SWITCH budget (EUR)*	*Matching funds (EUR)*
2009	16,000	45,000
2010	14,000	17,266

7. Dissemination Plans

Target Audiences/rationale:
Metropolitan and district assemblies and assembly men and regional authorities;
General public, Farmers association

Planned Publications: Papers will be presented at both international and national academic conferences/journals as well as other available outlets athat ensures wide dissemination beyond the domains of academics .

Media:
Linked with the media strategy of the SWITCH LA

Other (workshops, conferences, etc.):
Field Trips will be organized especially for assembly members from other areas so they could learn more and look at the possibility of having such systems in their localities.

Brochures will be circulated among LA members,

8. Training activities (activity, location, timeframe)

Before the start of demo project
Training on urine use for agriculture .

During the project:
-on the job training on the methodology during participatory handling and use of urine in the farm

After the project
1 Technical training introducing tested method for urine collection, handling and use to irrigation farmers, agric extension workers of the Ministry of Food and Agriculture and other LA-WG members working with farmers.

2. Up-scaling training workshop for for duplicating demo project in a bigger scale – to a larger group

Used literature

Cofie, O., Danso, G., Larbi, T., Kufogbe, S.K., Obiri-Opareh, N., Abraham, E., Schuetz, T. and M. Henseler (2006): *Urban agriculture in Accra, Ghana assessing livelihood potentials and policy mechanisms.* A working paper for the RUAF project

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Jönsson, H., B. Vinnerås, C. Hoglund, T.A Stenstrom, G. Dalhammar and H. Kirchmann (2000): *Recycling*

Source Separated urine. (English Summary) (Kallsorterad humanurin). VA-Forsk report 2000-01, VAV AB, Stockholm, Sweden

Obirih-Opareh, N. and S. Van de Geest (2000): *Toilet and Sanitation in Ghana an urgent matter.* Accra, Ghana. Institute of Scientific and Technological Information (INSTI) of CSIR.

Obirih-Opareh, N. and T. Otchere-Larbi (2007): *From Awareness to Action; policies on urban agriculture in Accra.* Retrieved from http://www.ruaf.org/node/512 on 13/01/08

Obuobie, E., B. Keraita, G. Danso, P. Amoah, O.O. Cofie, L. Raschid-Sally and P. Drechsel (2006): *Irrigated urban vegetable production in Ghana: characteristics, benefits and risks.* Accra, Ghana. IWMI-RUAF-CPWF.

Smits, S.; P. Moriaty and C. Sijbesma (Eds.) (2007): *Learning alliances: scaling up innovations in water, sanitation and hygiene.* Delft. The Netherlands. IRC International Water and Management Centre (Technical paper; no.47).

Tettey-Lowor, Frederick (2008). Closing the loop between sanitation and agriculture in Accra, Ghana. MSc.thesis Wageningen University, Urban Environment Group, Department of Environmental Sciences.

WHO (2006): *Guidelines for the Safe Use of Wastewater, Excreta and Greywater Volume 4: Excreta and greywater use in agriculture.* Paris, France. World Health Organisation

Ecosan Urinals__Demonstration Project Details

Activity	Tasks	Timeframe for task	Deliverable & due date	Lead partner/ workpackage	Comments
Social marketing and economical feasibility	Awareness creation, assessments of demand Cost assessment of infrastructure changes and of collection services; benefits of increased yield	February 2008-May 2008	August, 2008	WUR / IWMI, WP 4.1	Conducted through thesis work of Frederick Tettey-Lowor
Site selection	Identification of pilot sites, based on interest of potential urinal owners	May 2008	August, 2008	WUR / IWMI, WP 4.1	Conducted through thesis work of Frederick Tettey-Lowor
Construction	Installation of storage tank for urine	January – March 2009	March 2009	WUR / IWMI, WP 4.1	The construction of storage tanks will be financed and supervised by Safi Sana / Aqua for All through Frederick Tettey-Lowor
Training	Training of urban farmers and other stakeholders how to use urine for fertilization	January – March 2009	March 2009	IWMI, WP4.1	
Research & demonstration	The use of urine as fertilizer and the potential of crop yield increase as compared to crop production without the use of fertilizer will be demonstrated	October 2008, 2009	January 2010	IWMI, WP 4.1	
Monitoring and analysis	M1. Establish monitoring systems for the functioning of ecosan urinals M2. Monthly monitoring of the urinals	M1: to M2 to M3. to	M1 Summary report of the installed equipment and testing. September 2008 M2 Excel data sheets (six monthly	IWMI, WP 4.1 IRC 6.3	The extent of data collection will be enhanced if possible through the completion of research projects for undergraduate and masters students.

	M3. Measuring the impact of ecosan demonstration.		summaries) M3 Report on the findings from the analysis of the demonstration project data. January 2010		
Reviews and support studies	R1. Assembly members for other areas use ecosan urinals in their localities R2. AMA bye laws and regulations and opportunities for extensive use of ecosan technology for public urinals R3. Impact assessment of use and scaling up	R1 End 2008 R2 End 2009 R3 End 2010	R1Summary report R2 Summary report R3 Summary report	WUR/4.1	The completion of the reviews will depend in part on student interest and availability to complete the research.

Ecosan Urinals___Demonstration Project Budget

Year	Partner	Budget (EUR)	Matching Fund Organisation (name)	Budget (EUR)	Total Budget (EUR)
2006					
2007					
2008					
2009	IWMI	€ 15,000	Aqua for All / Safi Sana Ltd	€ 45,000,00	€ 60.000.00
2010	IWMI	€ 15,000	Aqua for All / Safi Sana Ltd	€ 17,266.60	€ 32,266.60
2011				€ 62,266.60	€ 92,266.60

Budget Summary for 1 year

S/No	Item Description	Amount (∈)
	Collection and Transport of urine	**Financed by Aqua for All / Safi Sana Ltd**
1	Construction of holding tank for urinal collection (2 urinals)	€ 3,860.00
2	Miscellaneous items eg. hose and Cart trucks	€ 200.00
3	Purchase of truck (6 tons from the US)	€ 30,000.00
4	Salary of co-ordinator (part time)	€ 12,000.00
5	Salary of driver	€ 2,400.00
6	Running cost of vehicle	€ 3,000.00
7	Unforeseen (15%)	€ 5,146.00
8	Contingencies (10%)	€ 5,660.60
	Sub-total	**€ 62,266.60**
	Demonstration and research on the use of urine as fertilizer	**Financed by IWMI through SWITCH**
	Investment and operational costs	
9	Urine storage tanks on site	€ 3,000.00
10	Research/Demo materials	€ 1,000.00
11	Field Work – data collection / analysis	€ 7,000.00
	Personnel	
12	Researcher 0.5 month /yr @ 6,000/month Euros	€ 6,000.00
13	Field Assistant – 6 months/yr @1000 Euros	€ 12,000.00
14	Local Travel	€ 1,000.00
	Sub-total	€ 30,000.00
	Total project costs	**€ 92,266.60**

IDENTIFICATION OF POTENTIAL PHARMACEUTICAL RESIDUES PRESENT IN URINE SAMPLES COLLECTED FROM A PUBLIC URINARY LOCATED WITHIN THE MARKET ADJACENT NOVOTEL HOTEL, ACCRA.

COLLINS TAY,
CSIR WATER RESEARCH INSTITUTE
ACCRA

January, 2010

ACKNOWLEDGEMENT

This study has been carried out within the framework of the European Research Project SWITCH (Sustainable Urban Water Improves Tomorrows' City's Health). SWITCH is supported by the European Commission under the 6th Framework Programme and contributes to the thematic priority area of "Global Change and Ecosystems". Facilities provided by the International Water Management Institute, Accra are hearby acknowledged.

TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY

A survey was conducted in the market adjacent the Novotel Hotel in Accra to identify the potential lipohpylic pharmaceutical residues likely to be present in urine samples collected from a public urinary located within the market premises. Questionnaires were designed to collect information on the major sicknesses/diseases and the drugs used in the treatment of these sicknesses/diseases from respondents within the market premises. Out of the 150 respondents, malaria (>60%) was identified as the major sickness in the study area. Fever (<37%) was the second major disease identified, stomach (14%), body (10%) and waist (6%) pains were also reported as sicknesses that were common among the respondents. Other sicknesses (eye defects-4%, Pneumonia- 2%, Jaundice- 2% and Typhoid -2%) were also reported. Based on this study and that conducted by Sinar. E (2008) as reported in this study, the major lipophylic pharmaceutical residues expected to be present in human urine from the public urinary located within the market are Chloroquine, Amodiaquine and Lumefantrine.

1.0 Introduction

1.1 Background

Human urine has recently been regarded as an alternative fertilizer for agriculture due to its relatively high macronutrients [nitrogen (N), phosphorus (P) and potassium (K)] contents (Mukolus, 2008). Urine is a high quality, low-cost alternative to commercial fertilizers. It is especially rich in N and also contains substantial amounts of P and K. The fertilizing effect is rapid and the nutrients are best utilized if the urine is applied prior to sowing and up until two-thirds of the period between sowing and harvest (EcoSanRes Factsheet 6, 2004). Urine has a fertilizer value of N/P/K 18:2:5 (Linden, B. 1997) and for urine mixed with flush water, the ratio can be N/P/K/S 15:1:3:1 (Palmquist, H *et a*l., 2004). Each individual produces 1-1.5 L of urine per day, the chemical composition of which depends on his/her feeding habits, the amount of drinking water consumed, physical activities, body size and environmental factors (Sullivan, L.P *et al*., 1982). In general, pure human urine contains very few enteric micro organisms (Heinonen-Tanski, H. *et al*., 2007). The nutrient content present in human urine may mean it can be a good fertilizer for plants. This may be increasingly important in the future, with population growth and the corresponding increased demand for food.

However, the use of human urine as an alternative fertilizer is associated with the risk of spreading pharmaceutical residues on to agricultural fields and to the vegetable produce. The uptake of pharmaceuticals by plants and the effects they have on plant physiology and development are of major interest especially for agricultural crops in terms of fertilization with urine. Literature indicates that, pharmaceutical uptake by plants is

correlated to the molecular weight of the pharmaceutical drug (Topp, *et al.*, 1986) and the octanol-water partition coefficient is considered as a driving force for its uptake (Briggs et al., 1982). Pharmaceuticals can affect plant growth when dosed in sufficient concentrations (Grote *et al*., 2004). The question is, whether concentrations added as a result of urine application to the fields are causing any adverse effects and how these effects would themselves manifest. Currently, little is known about the fate of pharmaceuticals regarding their accumulation in soil, transfer to groundwater, and incorporation by plants from soil in the case of fairly high concentrations of pharmaceuticals as expected for urine.

Even though urine use as an alternative fertilizer in agriculture is beginning to gain grounds in other countries across the world such as Asia, Europe etc, this ecologically sanitized practice has not yet been introduced in Ghana.

Accra is one of the Ten (10) demonstration cities under the Sustainable Urban Water Management Improves Tomorrow's City's Health (SWITCH) Project with workpackage 5.2 which focuses on urban and peri-urban agriculture being managed by the International Water Management Institute (IWMI), Ghana. The project aims at developing possible interventions to effect significant improvements in agricultural production, processing and marketing and other livelihood activities using freshwater, storm and wastewater among others. Currently, as part of the project objectives, urine use as an alternative fertilizer in urban and peri-urban agriculture is being considered. However, information on the major drugs administered in Accra is needed to identify the potential major pharmaceutical residues likely to be present in urine in Accra. This project seeks to assess the impact of pharmaceuticals in urine use as an alternative

fertilizer in urban agriculture in Accra. The study employed the concept of responses from respondents selected from the market adjacent Novotel Hotel in Accra using questionnaires.

1.2 Objectives of the study

The overall objective of the study is to identify the potential pharmaceutical residues present in urine samples in Accra and therefore, characterize the lipophillic pharmaceutical residues most likely to bio-accumulate in soil, water and plant.

2. Method

The descriptive survey method was adopted in collecting information on the common sicknesses/diseases among the people in the market. The target population for the study consisted of both adult men and women who come to the market place to either buy or sell, and are likely to use a commercial urinary located within the market place where urine samples would be collected for analysis to identify potential pharmaceutical residues likely to be present in urine samples from the commercial urinary. A meeting was organized among the respondents by their leaders at one of the offices of the Ghana Private Road Transport Union (GPRTU) for collection of information by the project team. During each visit, a presentation was made by a member of the team to the respondents on ‘the need for Ghana to adopt the use of human urine as an alternative fertilizer’. After each presentation, participants are made to provide responses to questions in the questionnaires designed to collect information on the major drugs administered in Accra. A total of 150 questionnaires were administered. The questionnaires consisted of two parts. The first part collected personal (age, gender, literacy, etc) information on respondents and the second part collected information on

drug use (such as; do you visit the hospital anytime you are sick?, If your response is yes, which hospital?, what sickness/disease were you diagnosed of?, which drugs were prescribed to you? how often do you suffer from this sickness/disease?, etc.) (see appendix).

3.0 Results and discussions

3.1 Results

Table 1: Personal information of respondents

Gender	No. of Respondents	
	Men	Women
	36	114
Age		
18 – 30	-	6
31 - 40	10	15
41 -50	14	63
51 – 60	-	18
Above 60	12	12
Literacy		
1st Cycle	22	49
2nd Cycle	11	57
3rd Cycle	3	8

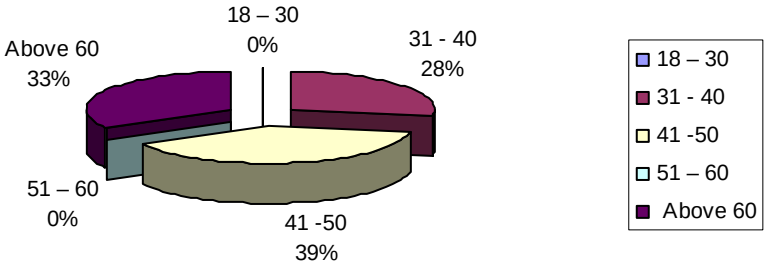

Fig 1: Percentage age of respondents- Men

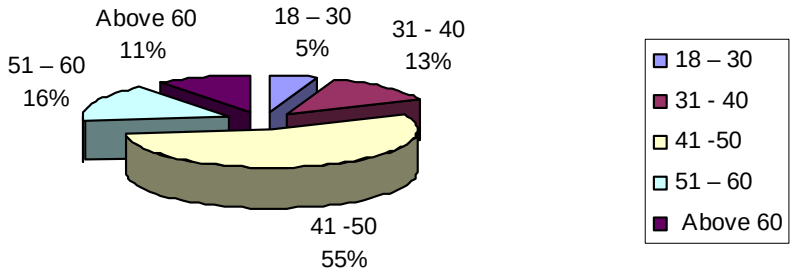

Fig 2: percentage age of respondents- Women

The percentage age of respondents for men and women are presented in Figs 1 and 2 respectively. The ages varied between 31 and above 60 years for men, with most of them between 41-50 years (39%), while, the age percentage age of respondents for women varied between 18 and above 60 years. Similarly, the ages of most women respondents were between 41-50 years (55%).

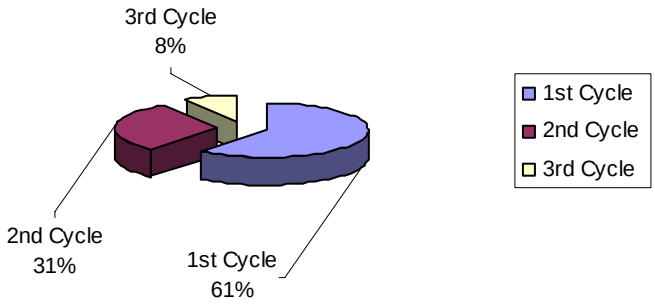

Fig 3: Percentage literacy of respondents-Men

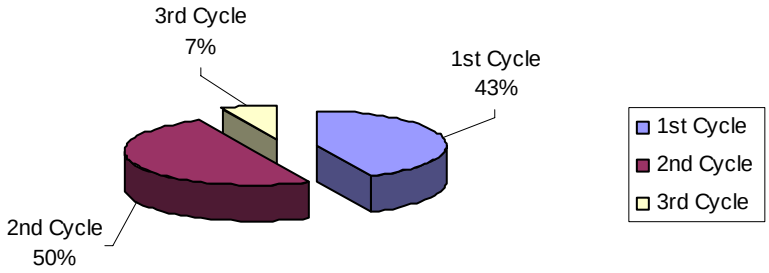

Fig 4: Percentage literacy of respondents-Women

Figs 3 and 4 present the percentage literacy of respondents for men and women respectively. 44% of the men respondents are first cycle literates, while, 50% of the women respondents are second cycle literates.

Sickness/disease	No. of Respondents	
	Men	Women
Malaria	30	60
Fever	10	45
Body pains	-	15
Eye problems	-	6
Pneumonia	-	3
Stomach pains	3	18
Waist pains	-	9
Jaundice	-	3
Typhoid	-	3

Table 2: Disease/ sickness prevalent among respondents

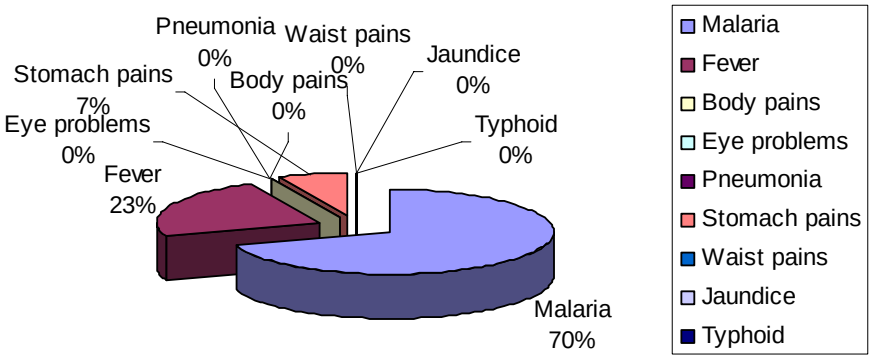

Fig 5: Percentage sickness/disease of respondents- Men

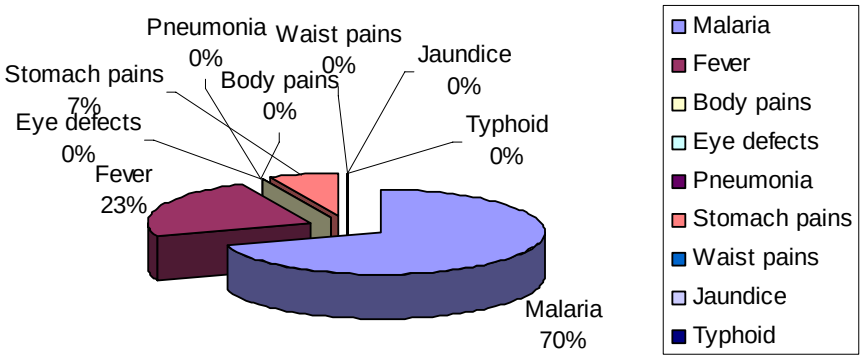

Fig 6: Percentage sickness/disease of respondents- Women

Figs 5 and 6 present the diseases prevalent among the men and women respondents respectively. The diseases reported by the respondents were malaria, typhoid, jaundice, stomach pains, waist pains, pneumonia, eye problems, body pains and fever. Of these diseases, malaria and fever ranked high for both men and women respondents. 70% of men respondents reported malaria attack, while, 36% of women respondents reported malaria as their common disease. Fever was the second most common disease reported by both men and women respondents, with 23 % and 28% respectively. This finding is in conformity with the Ghana Health Service (GHS, 2005a) study on major diseases in Ghana. According to the GHS, the major health problems in Ghana are malaria followed by acute respiratory infections and skin diseases. Other reported diseases included: typhoid (2%), jaundice (2%), stomach pains (11%), waist pains (6%), pneumonia (2%),

eye defects (4%) and body pains (9%)- for women respondents and stomach pains (7%)- for men respondents.

Sickness/disease	Drug use	No. of Respondents

Table 3: Drug use

Malaria	Amodiaquine Chloroquine Can't remember	9 12 69
Fever	Atesunate Efpac Alaxin Fragil Amoxacylin Procold Pain killer Paracetamol Brufen	3 15 3 6 6 6 18 27 3
Waste pains, stomach pains and body pains	Pain killers	58
Others (Jaundice, Typhoid,	Ventolin	3

pneumonia, eye defects)	Antibitics	6

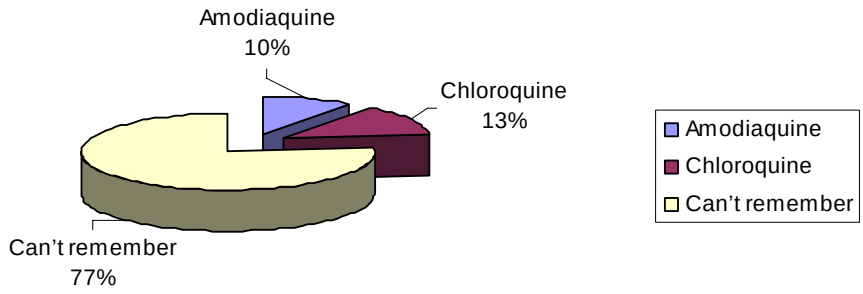

Fig 7: Percentage drug use - Malaria

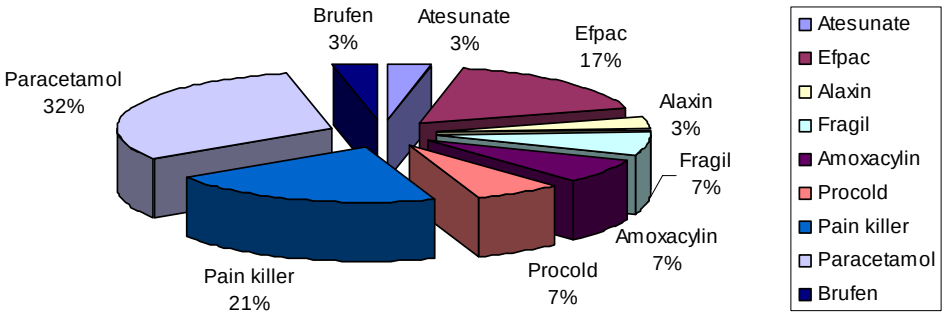

Fig 8: Percentage drug use – Fever

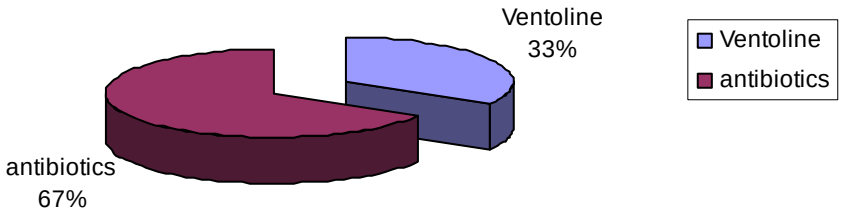

Fig 9: Percentage drug use- Others

In order to estimate the drug use in Accra, respondents were asked to provide the names of drugs either prescribed to them by a medical doctor or they buy at the counter in pharmacy shops when sick. Figs 7, 8 and 9 present the percentage drug use. In the case of malaria, 77% of respondents could not remember the names of the drugs, 13% used chloroquine and 10% used amodiaquine. 32% of respondents used paracetamol, 3% used brufen, 3% used atesunate, 17% used Efpac, 3% used alaxin, 7% used fragil, 7% used amoxacylin, 7% used procold and 21% used painkillers to treat fever. Other drugs used by the respondents included; antibiotics (67%) and ventolin (33%).

3.2 Discussions

All 150 respondents surveyed in this study aged 18 years and above had at least basic education with 45% having gone through secondary education.

3.2.1 Malaria

60% of respondents reported having had malaria at one time or the other. This results is in conformity with the Ghana Health Services (GHS, 2005a) study on major diseases in Ghana and reflects the potential presence of antimalarial drugs in urine samples that may be collected from public urinary located within the market.

3.2.2 Fever

37% of respondents reported having had fever attacks at one time or the other. In general, the symptoms of fever are similar to malaria and therefore, of this percentage, malaria cases could be part. If this was the case, then, the percentage of respondents who reported

malaria in this study could further increase. This makes malaria the most (>60%) common reported sickness in this study.

3.2.3 Stomach, body and waist pains

Stomach (14%), body (10%) and waist (6%) pains were the third, fourth and fifth sicknesses reported in this study. This suggests that drugs used in easing pains (pain killers) are potential drugs which could possibly be present in urine samples collected from the market.

3.2.3 Other sicknesses

Eye defects (4%), Pneumonia (2%), Jaundice (2%) and Typhoid (2%) were the other sicknesses that were reported in this study. These together forms 10% of the total sicknesses reported in this study and therefore may not be the focus of the study to characterise the potential pharmaceutical residues in urine fro Accra.

3.2.4 Drug use

An attempt was made to identify the drug used by the respondents to treat the reported sicknesses. The study showed that, 77%, 13% and 10% of the respondents who reported having had malaria attacks could not remember the specific drugs, used chloroquine and amodiaquine drugs respectively. 32% of respondents used paracetamol, 3% used brufen, 3% used atesunate, 17% used Efpac, 3% used alaxin, 7% used fragil, 7% used amoxacylin, 7% used procold and 21% used painkillers to treat fever. Other drugs used by the respondents included; antibiotics (67%) and ventolin (33%). This suggests that, antimalarial drugs, which are shown to be the major drugs being widely used, cannot be specifically identified by this study. However, Sinar. E (2008) conducted an M.Sc study on ‘Pharmaceuticals in human sanitary products for use in tropical agriculture- Case study at the Valley View University in Accra, Ghana. Part of he study estimated the distribution of antimalarial drugs in the Greater Accra Region. The study indicated that, quantities of Lumefantrine, Amodiaquine, Quinine, Chloroquine, Pyrimethamine, Sulfadoxine and Artemisinin and its derivatives were available at health facilities and pharmacies within the Greater Accra Region. Of these antimalarial drugs, the study recommended Chloroquine, Amodiaquine and Lumefantrine as the drugs which need further studies due to their persistence in the environment. This recommendation suggests

that, Chloroquine, Amodiaquine and Lumefantrine are lipophilic and are likely, to be present in human urine.

4.0 Conclusion

This survey showed that, out of a total of 150 respondents in the market adjacent the Novotel Hotel in Accra, malaria (>60%) was the sickness identified as the most prevalent. Fever (< 37%) was the second most prevalent. Stomach (14%), Body (10%) and waist (6%) pains were also reported as sicknesses that were common among the respondents. Eye defects (4%), Pneumonia (2%), Jaundice (2%) and Typhoid (2%) were the other sicknesses reported in this study. Based on this study and that conducted by Sinar. E (2008) as reported in this study, the major lipophylic pharmaceutical residues expected to be present in human urine from the public urinary located within the market are Chloroquine, Amodiaquine and Lumefantrine.

5.0 References

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