



Community Behavior and the Exposure of River in Yogyakarta from Feses Coli Bacteria

Pajar Hatma Indra Jaya^{1✉}, Sriharini¹

¹UIN Sunan Kalijaga Yogyakarta, Indonesia

Article Info

Article History:

Submitted June 2017

Accepted November 2018

Published November 2018

Keywords:

River pollution,
behavior, knowledge

DOI

<https://doi.org/10.15294/kemas.v14i2.9721>

Abstract

This study started from data of Riskesdas of the Ministry of Health which regards Special Region of Yogyakarta as a region with a good habit of defecating. However, according to a research conducted by the Environment Agency in Yogyakarta, all rivers in this region contain faecal colibacteria far above the threshold. This study aims to explain the factors that led to contamination of rivers by faecal colibacteria in Yogyakarta. The researcher conducted observation in the rivers in Yogyakarta and interviewed some people who lived near the rivers regarding their habit and knowledge about the rivers' condition. This study concluded that the habit of defecating in rivers is rarely found in Yogyakarta and such habit will diminish naturally. However, there are some behaviors which give similar effects as defecating in rivers. The society does not know that such behaviors could lead to the presence of faecal colibacteria. More importantly, although the rivers in Yogyakarta contain faecal colibacteria which UNICEF considers as harmful, the society does not confirm that such condition is harmful. This way, such unhealthy behavior of the society still exists.

Introduction

River condition in a city become one of the parameters of water quality in the region, when it clean then can be sured the water consumed is good and vice versa. Yet in Indonesia, many rivers are turned to mega trash can. River is wrongly understood so that many people canalize their domestic trash to it. Every day, equal to 192 trucks of garbage is dumped into the river (Maryadie, 2008). Many kinds of the garbage are dumped to the river from organic to unorganic, from human feces to instant noodle package. As result, it is contamited and dirty, furthermore, the water is contaminate with bacteria and can cause disease to the population.

Indonesia is on rank two after India related with defecating habit. Unicef report in 2015 mentioned there were 51 millions people defecate carelessly (Unicef, 2015). Another 109 people did not have access to proper sanitation facility while another 40 millions defecate anywhere they could. This data was close to Ministry of Health record in 2013 mentioning there still 32.25 millions people (12.9%) of the Indonesia population defecate carelessly (Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan RI, 2013).

The government has tried many ways to overcome river pollution. One of the efforts is to facilitate availability of trash can and domestic waste dumping point, like conducted by DI

✉ Correspondence Address:
UIN Sunan Kalijaga Yogyakarta.
Email : 198104282003121003@uin-suka.ac.id

Yogyakarta government through Environment Agency (Badan Lingkungan Hidup/BLH) and General Construction Office (Dinas Pekerjaan Umum), through Community Waste Dump Instalation (Instalasi Pembuangan Limbah/Ipal Komunal) and Community Toilet (WC Komunal) for people living on the bank of the river. This program is not cheap at cost. One Community Waste Dump Instalation cost 250 millions rupiah. Though it is expensive, there was a lesson from Burianga river restoration in Bangladesh that recovery of polluted river is not only a must but also can be justified socially and economically since the benefit is more economically valuable rather than ignore it (Alam, 2008).

The effort can not be said as a failure since according to Risdinkes in 2007, DI Yogyakarta Region was categorized as a region with defecating behavior good, with score more than 91.9% (Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan RI, 2013). DI Yogyakarta score was only below DKI Jakarta and Kepulauan Riau. But from the perspective of faecal colibacteria in the rivers of Yogyakarta, the result is quite amazing. Environment Agency (BLH) research in 2013 until 2016, consistently indicated all river water in Yogyakarta contained faecal colibacteria above national threshold (50 per PT/100 ml air) as Permenkes RI No 492/MENKES/PER/IV/2010 and regional threshold (1.000 per PT/100 ml). Just like on the Gajah Wong River on February 2013 and 2014 indicated 1,100,000. Winongo River on February 2015 indicated 460,000. Code River on September 2015 indicated 1,100,000 (BLH DIY, 2015). This research objective is to find out the community behavior causing the contamination of faecal colibacteria in the rivers of DI Yogyakarta surpassing the threshold.

Method

This research is a health sociological study with qualitative descriptive property related with river bank community behavior and knowledge causing the river exposure by E. Coli bacteria in Yogyakarta. Data was collected by interview, documentation and river tracking observation related with defecating behavior of the community. This research had been taking place on Gajah Wong River (Nologaten

and Gowok-Ledok area) and Winongo River (Bener and Notoyudan Yogyakarta area, as well as Mulyodadi Bantul Region) for five months, from August – December 2016.

The informant recruitment technique was done purposively and combined with snowball technique, which the informants are taken from persons meet the living around the river bank criteria. The snowball technique was used when the disposal points had been found. The informants in this research are 36 persons. The data analysis model used is Milles and Huberman Model, also known as interactive analysis. In this model there are three analysis flow, which are data reduction, data presentation and conclusion. To avoid over subjectivity, this research also use data source and method triangulation technique, which check the consistency from many informant, interview result, observation and documentation.

Result and Discussion

Faecal coliforms or faecal coli is a bacteria caused by faeces contamination. This bacteria is a microorganism commonly used as the indicator of water quality. When the water has been contaminated by this bacteria then can be concluded that the water is no longer proper to be consumed. The coli bacteria is looked like a stick, negative gram and non sporulation. It grows on 37°C temperature. Number of coliform obtained from the temperature incubation usually determined as total coliform, meanwhile the faecal coliform part of total coliform and presented by total thermotolerant coliform bacteria able to grow on 44°C or 44,5° C temperature (*Thermotolerant (faecal) coliforms*). Faecal coli growth can be hampered with boiled water or by pouring some chlor. Faecal coli lives mostly on human or animal colon and can cause an infection in the colon resulting as diarrhea. This can be happened when human immunity is weak, particularly on the newborn baby or the elderly (Pachepsky, 2011). According to Unicef, everyday there are more than 370 toddler mortality due to careless defecating - caused by disease,

Nearly all study regarding river pollution find out human is the main source of pollution. Mulasari research regarding garbage problem in Yogyakarta found out that human is the primary actor. Speaking of human, human

(people) living around the river bank is the actor considered mostly responsible to river pollution. The more dense the river bank is populated the more polluted the river. On many research location can be seen that domestic waste contaminate the river even more than industrial waste (Sasongko, 2008; Melawati, 2013; Wijaya, 2013; Kurnianti, 2014).

When human has been awared to healthy behave then environment problem will be solved along. Therefore to check the community behavior is important to determine the root cause fo river exposure, including in Yogyakarta, to coli bacteria. Based on observation result and field interview can be found several factors affecting the river exposure to faecal coli bacteria in Yogyakarta are defecating culture that doing it directly to the river, lack access to community toilet and various knowledge regarding waste disposal model.

Generally, most of Yogyakarta people actually no longer defecate on the river anymore, though this research still found people doing it. They are old people age 65-75 years living near by the river. They were born around 1950s. On that time defecating in the toilet was not common. Defecating was done directly on the river. Based on the interview data, they consider defecates in the toilet/bathroom means keeping the faeces inside the house.

In terms of education and economic level, people who still defecate on the river have low economic and education level. These groups are cathegorized in two type, first they who are forced to do it since they do not have access to toilet, whether due to they do not have one or the community toilet was out of use and not being repaired. These cathegory actually getting difficult to find because generally around the river in Yogyakarta there has been community toilet, whether it is built by the community or government aid. Yet in the observation can be seen that many community toilet abandoned, due to less and less people utilize it. Second cathegory is people who has toilet in their houses or there is public toilet around but still defacate on the river. For these cathegory, the toilet is usually built for their children. Why don't they use it as well? According to interview result, they just feel comfortable to defecate on

the river since it is their habit since child age. Max Weber view this behavior as traditional act, which is irrational act generated from a habit without consious reflection or plan (Hedoin, 2009). When being ask for the reason for defecate on the river, they only replied that when they do it on the toilet, they can not make it done. The toilet is an alternative when there is sudden unbearable will to defecate or during the flood. Other that those, they prefer to defecate on the river. In Javanese it is called "ngising neng kali" and it is not a disorder in their mind so they do not feel ashamed.

Those type are done by relatively old people and this behavior will gone along the time. The education and information development make defecating on the river as disorder by the community, thus it does not pass to next generation. Beside community factor, the river condition in Yogyakarta day after day make it not possible to be used as defecating place. The rivers in Yogyakarta are become more contaminated by plastic garbage and large trees that comfortable to hold when defecate are no longer exist. As consequence of river's bank layout change in the city, then defecating on the river behavior will be harder to be found in a city compare to the river in villages. This is because the river in the village usually located a little far from the road and covered by plants that can be a shade and hold by the people who wants to defecate on the river, while in the city the plants have been replaced with houses. This condition align with Riskesdas survey in 2013 mentioned toilet users in the city are larger than in the village. In the village, the proportion of family still defecate carelessly is 20.8% as in the city only 5.1%

Defecating on the river is one of ancient behavior on the past (culture). Along with the emerge of knowledge and development of culture, defecate on the river is replaced with defecate on the toilet/WC (Water Closet). The emerge of closet and bathroom alter community behavior, yet there are communities comfortably doing it thus they are difficult to adjust their culture. When it is forced to them, on early times there would be culture lag, like people accept the habit to defecate on the toilet yet when they done, they always forget to flush since the old culture (defecating on the

river) did not obligate them to do it. Though the habit has no longer passed to the young generation, yet the extinction of this old culture is happened evolutively along with the passed away of the old people. This can be seen from the interview with Id (23 years old) on October 21, 2016 telling the old habit to defecate on the river and the current habit of the grandparents:

Actually we have toilet in the house, but when I was on Junior High, I defecated on the river with my grandfather. After Senior High, I rather shy yet my grandfather still doing it. He said he prefer that way since the faeces directly carry out along with the river flow. He once defecated in the toilet due to the river was flooding yet after he done, he did not flush it. So we know if there is such thing, it must be him.

The difficulty of behavior alteration that become a cultural also can be read from Marthen Sagrim, et. al. paper regarding Taburta tribe behavior alteration in Papua to healthy life. The intervention program to healthy life that contradictive to local belief/knowledge was unable to be applicated, while the behavior aligned with local belief can be adopted easily. Such as the Taburta do not want to use toilet which not separate between male and female since there is local belief that unseparated toilet between male and female will cause respiratory disease and death to the male (Sagrim, 2015). Not only in Indonesia, Celia McMichael wrote the experience regarding the defecating program in Nepal that should be aplicated slowly by adopting all local stories, furthermore the program event must be translated into the pictures as people will (McMichael, 2017). Based on the explanation, it can be said that though this research confirmed Unicef found mentioning the reason of careless defecating behavior in Indonesia is the unavailable of access to sufficient closet (economic limitation factor), yet nowadays there still find the people although they have inhouse closet, not using it since defacating on the river has been a habit for long time and difficult to alter.

During the observation, the researcher also found several people were constrained to defecate on the river. The reasons are working in a place far from toilet access, farmer working on the rice field that of course no toilet around and some taxibike driver with similar reason.

From the taxibike driver stationed on Paker Mulyodadi cross near Winongo river, can be heard that mosque or gas station nearby should be a proper alternative yet those taxibike drivers feel hesitate, moreover, they never actively pray on the mosque. In an area with dense population, like the boarding house with limited toilet, also found defecating on the river behavior for emergency reason (necessary).

From above, can be seen the condition of the rivers in Yogyakarta nowadays no longer sustainable for the habit. Yet if we walk along the river in dense populated area like Gowok-Ledok Gajah Wong, there will be PVC pipes come out from the ground and head to the river. Some of them are domestic waste pipes and some others disposal line of houses septic tank. This is new problem after the defecating on the river culture is left behind.

Some of the pipes has been properly installed, which mean they are disposal line after going through decomposition and precipitation basin twice, but oftenly found several pipes comes directly from decomposition basin only or directly from the closet. The last one is actually the same like defacating on the river, only the person is not visible by the bank of the river. This model appears since some houses located precisely on the river side and do not have sufficient land to build house waste treatment installation. For these families the importance matter is when a person defacates he/she can't be seen from the outside. So there has been a shy feeling to defecate on open space yet not realize that faeces disposal directly to the river can spread many disease, includes the faecal coli bacteria. This kind of case can be solved by the build of joint waste treatment installation (Ipal Komunal). This is as said by AB (56 years old), community neighbourhood head on Gowok-Ledok Gajah Wong, November 11, 2016.

Well nowadays people are shy to defacate directly on the river, unless necessary. The houses have had a toilet, yet some of them do not have the septic tank. The faeces is disposed directly to the river. The government actually has build the Ipal Komunal, yet still on limited numbers.

Another factor that can be the cause of faecal coli bacteria development is due to

accident matter, since many of septic tanks in Yogyakarta are build cascadelly and the last is flown to absorbtion weel. This absorbtion weel is a hole covered with fibres from palm tree. Previous understanding is it will not be a matter as long as the distance from weel and toiled is more than 10 metres. Yet latest study found out that the faeces tank should be excavated regularly. When this has never done yet the tank does not full for years, it actually indicate underground leak. This means faecal coli bacteria can contaminate water sources, include the river.

Beside above factor, the large number of faecal coli bacteria on Winongo river and Gajah Wong can also because of cattle slaughter and goat satay seller who clean the gut on the river. When walk along the river also found a cow farm disposing the waste directly to the river.

Talcot Parson publicate the phrases health behavior and sick behavior (*sick role theory*). Sick behavior is self perspective about self condition thus he will think as if he is sick, while actually just fine. Sick behavior can be done by people that actually health, thus it can be seen as deviance (Heidarnia, 2016). As an example, a pregnant female is actually not sick, yet due to self concept supported by community collective aware then a pregnant female can sometime cravings abnormal things. While health behavior is self perspective about self condition that he is health thus though he is sick he can do health people acts.

By adopting the Parsons sick role theory, factors affecting river water quality above can be cathegorized as health and sick behavior. Defacating on the river due to necessary condition and waste water treatment installation failure still can be considered as health behavior, while intendingly dispose the faeces to the river whether visible or not considered as sick behavior. Nevertheless, all those behavior comes from community unawareness that it can severe river water quality. From health science perspective, they do not aware that the act is unproper and unhealth.

Peter L. Berger said social act can emerge from objectivication effect in form of general knowledge internalization and subjectivication effect in form of experience. Internalization in this context is whether may

or may not to defacate on the river, while the experience will give understanding whether the internalization is affirmed or hesitated in the actual life. Peter L. Berger publicated the realisimum concept which mean the most real considered knowledge. The most real knowledge is pragmatic daily knowledge aligned with the "here" and "now" context. When the most real knowledge is hesitated, then someone will suspend the hesitation as long as daily knowledge proved the other way around. Beside, social act based on pragmatic concept in term of act to maximalize beneficial options (Karman, 2015). Therefore the act of river bank population to defacate directly on the river is happened due to the "beneficial" felling rather than to use government provided and built facility.

The community never consider defecating on the river is an act that contradictory to religion and social value, as well as government regulation. There is no verse in the religion book that internlized by the community mentioning defecating on the river as a sin. While from context of positive law, according to the community live on river bank, also does not mention any prohibition from Yogyakarta government related with the act. This is justified with field condition where there is no warning sign is placed (In Yogyakarta the warning signs just have just been installed in 2017). This is different with the prohibition not to dispose any waste to the river or poisoned fishing which beside the regulation also can be seen many warning signs are placed. The rarely informed prohibition is due to defacating on the river, realized or not has not been an urge social problem. The regulation commonly used to socialize the prohibition to defacate on the river is Peraturan Pemerintah (PP) Number 20 Year 1990 and PP Number 82 Year 2001 about Water Management and Water Regulation. In the government regulation, mentioned all domestic waste should be treated before being disposed to general channel. The region that clearly prohibit to pee and defacate on the river is Samarinda City through Perda No 2 Year 2011. Yet, though Samarinda has had written regulation, due to no strict law enforcing it is not effectively followed (Hermawan, 2013).

The urgency proposed by the health

experts regarding the harmful of defecating on the river is not considered as the most real knowledge. The community does not consider it harmful. Eventough according to health science it is considered quite harmful since the faeces contains millions of pathogen bacteria, from E. Coli, worm, protozoa and virus causing diarrhea, penumonia and other harm disease. Unicef even released a campaign called “Tinja Tinja” (Smash the Faeces) by presenting data that every day there is more than 370 toddler mortality caused by disease came from careless defacating. From data of Riset Kesehatan Dasar (Riskesdas) Balitbang Depkes RI, diarrhea placed top position (31%) of infant mortality cause (29 days – 11 months age) and 25% for toddler (12-59 months age) while on second rank is pneumonia (Badan Penelitian dan Pengembangan Kesehatan Departemen Kesehatan RI, 2013).

Though medically coli bacteria in the rivers of Yogyakarta far surpassed the threshold, yet it seemed like the community consider it as social problem since they do not directly feel the effect. Eventough the faecal coli bacteria is high, yet there is no diarrhea plague in Yogyakarta, as said in medical explanation. The rivers in Yogyakarta is not only exposed by faecal coli bacteria, based on Environment Agency data in Yogyakarta in 2015, can be seen that from 33 parameters, there are 18 that surpass the river quality standard, such as total coli bacteria, lead contain, copper contain, zinc, etc (BLH DIY, 2015). Yet due to the effect of the substances is not directly felt by the community then it still considered as real knowledge. The condition is similar with smoking dangerous effect, though doctor, government and tobacco company have warned it, yet the smokers do no find the severe incident presented directly. As result, the awareness to quit smoking never exist in the smoker way of think.

Above data raise a question, when the people will be disposed to conserve the river? A study from Hesti Purnamasari related with river pollution at Perangat Selatan Village, Kutai Kartanegara found out that community participation to conserve the river is difficult, it just emerge when the pollution become visually harmful and directly affect the people daily life. When the people can no longer able to

consume the river water, then they just think to participate to conserve it (Purnamasari, 2012). Alprida Harahap, et. al. also found nearly same conclusion that the Padangsidempuan people just been awared to conserve Batang Ayumi river after they feel the result of pollution which are itchy as well as skin and eye redness caused by the pollution (Harahap, 2013). Eram Tunggul also concluded Jawesari Village, Kendal people became actively conserve the river with the government because it become resource of their drinking water. When the water quality is below the standard, then the people will directly feel the negative result (Tunggul, 2012).

Peter L. Berger said daily knowledge closest or the most felt by the community is considered the most correct. When this is tracked from previous study (Faisal, 2010), actually there are some researches regarding river polution in Yogyakarta from faecal coli bacteria, yet the information is not massively accepted by the community. The problem is only felt by environment and health experts, yet has not been felt by common peaple. This cause the commitment to against defecating on the river only awared by top level, but not touch daily life of people living on the bank of the river. The people has intant way of think (pragmatic), disposes the waste to the river has no direct effect to the community. Though sometime the effect is not felt by the person doing it, yet it is felt by the community living on the downstream of the river. There has not been awared that disposing waste to the river does not solve the problem, but only displace it.

Similar explanation found by Manabendu Chattopadhyay and Buddhadeb Ghosh when explained environment damage in West Bengal. With “Economic Man” concept, they described the farmer in West Bengal tends to maximalize the short range profit and ignore long range damage. Due to the environment damage caused by their farming was not directly felt at the moment then the conservation effort is considered as “irrational” and reduce the profit (Chattopadhyay, 1995). Eventough the result of environment damage, include the river pollution cost so much whether the cost to overcome the contamination (*costs-caused*) or cost due to river damage (*costs-borne*). For the contamination of Suroboyo River alone, Deni

Kusumawardani estimated the economic cost reaches 21 billions annually (Kusumawardani, 2012). Yet since the cost logic still not be felt by river bank community in their daily life makes there still many act that does not environmental friendly.

Conclusion

The river is basicly clean, it is human behavior make it contaminated. Poor behavior to this environment will go on as long as the community do not consider it as a bad thing (knowledge). Though the research regarding water quality always shows repeated result that all rivers in Yogyakarta have been exposed by faecal coli bacteria above the threshold (knowledge), yet daily knowledge closest with community reality does not indicate it as harmful act and social problem. As result the defecating on the river behavior (particularly indirectly) is difficult to be stopped and keep on going in the community. Based on this conclusion then this research advise to the government to educate the people so that their daily knowledge believe that defecating on the river and faecal coli are harmful.

Acknowledgement

This writing is one of the research result funded by Lembaga Penelitian dan Pengabdian Masyarakat (LP2M) UIN Sunan Kalijaga. Therefore, the writer acknowledge the colleague in LP2M UIN Sunan Kalijaga. Also gratitude to Irfan Damarjati and Wahidatul Rizqi Firianti as researcher assistant in field data collection.

Reference

- Alam, K., 2008. Cost-Benefit Analysis of Restoring Buriganga River. *Bangladesh International Journal of Water Resources Development*, 24(4), pp.593-607.
- Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan RI., 2013. *Riset Kesehatan Dasar/Riskesdas 2013*. Kementerian Kesehatan RI. Jakarta.
- BLH DIY., 2015. *Kualitas Air Sungai DIY*. Badan Lingkungan Hidup DIY. Badan Lingkungan Hidup. Yogyakarta.
- Chattopadhyay, M., & Ghosh, B., 1995. Survival Strategy of Farmers: An Ecological Explanation From West Bengal Farms. *Journal of Human Ecology*, 6(3), pp.169-175.
- Faisal, W., & Nuraini, E., 2010. Validasi Metode AANC Untuk Pengujian Unsur Mn, Mg Dan Cr Pada Cuplikan Sedimen Di Sungai Gajahwong. *Ganendra*, 13(1), pp.27-36.
- Harahap, A., Naria, E., & Santi, D.N., 2013. Analisis Kualitas Air Sungai Akibat Pencemaran Tempat Pembuangan Akhir Sampah Batu Bola Dan Karakteristik Sertakeluhan Kesehatan Pengguna Air Sungai Batang Ayumi Di Kota Padangsidimpuan Tahun 2012. *Jurnal Kesehatan Lingkungan Dan Keselamatan Kerja*, 2(2), pp.1-9.
- Hedoin, C., 2009. Weber and Veblen on the Rationalization Process. *Journal of Economic Issues*, 43(1), pp.167-188.
- Heidarnia, M.A., & Heidarnia, A., 2016. Sick Role and a Critical Evaluation of its Application to our Understanding of the Relationship between Physician and Patients. *Novelty in Biomedicine*, 4(3), pp.123-134.
- Hermawan, T., 2013. Penegakan Hukum Lingkungan Terhadap Larangan Buang Air Besar (Hajat Besar) Dan Buang Air Kecil (Hajat Kecil) di Sungai Ditinjau dari Peraturan Daerah Kota Samarinda Nomor 02 Tahun 2011 tentang Pengelolaan Sampah (Studi di Sungai Kelurahan Karang Anyar Kota Samarinda). *Jurnal Beraja Niti*, 2(9), pp.282-293.
- Karman., 2015. Konstruksi Realitas Sosial Sebagai Gerakan Pemikiran (Sebuah Telaah Teoretis Terhadap Konstruksi Realitas Peter L. Berger). *Jurnal Penelitian dan Pengembangan Komunikasi dan Informatika*, 5(3), pp.11-23.
- Kurnianti, E., Nashrullah., & Irsyan, R., 2014. Beban Pencemaran Pada Kawasan Padat Penduduk (Studi Kasus Sungai Beliang). *Jurnal Mahasiswa Teknik Lingkungan Untan*, 1(1), pp.1-10.
- Kusumawardani, D., 2012. Estimasi Biaya Pencemaran Air Sungai: Studi Kasus Pada Kali Surabaya Sebagai Air Baku Untuk Produksi Air Minum. *Majalah Ekonomi*, XXII(2), pp.116-124.
- Maryadie, A.L.D.P., & Prihiawito, E., 2008. *Sehari Sampah Setara 192 Truk Masuk Sungai*.
- McMichael, C., 2017. Toilet Talk: Eliminating Open Defecation and Improved Sanitation in Nepal. *Medical Anthropology*, 2017, pp.1-17.
- Melawati, N., Sudarno., & Handayani, D.S., 2013. Analisis Pengaruh Buangan Limbah Domestik Terhadap Status Mutu Air Dengan Metode Indeks Pencemaran (Studi Kasus Sungai Banger, Kecamatan Semarang Timur). *Jurnal Teknik Lingkungan*, 2(4), pp.1-8.
- Mulasari, A., Husodo, A.H., & Muhadjir, N., 2016. Analisis Situasi Permasalahan Sampah Kota Yogyakarta dan Kebijakan Penanggulangannya. *Jurnal Kemas*, 11(2), pp.96-106.
- Pachepsky Y.A., & Shelton D.R., 2011. *Escherichia*

- Coli and Fecal Coliforms in Freshwater and Estuarine Sediments. *Critical Reviews in Environmental Science and Technology*, 41(12), pp.1067-1110.
- Purnamasari, H., 2012. Pencemaran Sungai Akibat Aktivitas Perendaman Karet Oleh Masyarakat Kutai Kartanegara (Studi Di Desa Perangat Selatan, Kecamatan Marang Kayu). *Jurnal Beraja Niti*, 1(12), pp. 1-39.
- Sagrim, M., Noor, N.N., Thaha, R.M., & Maidin, A., 2015. Kearifan Lokal Komunitas Adat Terpencil Suku Taburta Dalam Perilaku Hidup Bersih Dan Sehat Berbasis Rumah Tangga. *Jurnal Media Kesehatan Masyarakat Indonesia*, 11(4), pp.218-227.
- Sasongko, L.A., 2008. Pencemaran Air Sungai Tuk Akibat Air Limbah Domestik (Studi Kasus Kelurahan Bendan Ngisor dan Kelurahan Sampangan Kecamatan Gajah Mungkur Kota Semarang). *Momentum*, 4(1), pp.48-55.
- Tunggul, P.E., 2012. Pengelolaan Sumber Air Di Desa Jawesari Kecamatan Limbangan, Kabupaten Kendal. *Jurnal Kesehatan Masyarakat*, 8(1), pp.17-22.
- Unicef., 2015. *Laporan Tahunan Indonesia 2015*. Unicef. Jakarta.
- Wijaya, H., Arina, F., & Ferdinant P.F., 2013. Identifikasi Sumber Pencemaran Permukaan Air Sungai Menggunakan Analisis Multivariat. *Jurnal Teknik Industri Untirta*, 1(1), pp.23-28.