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# ANALYSIS OF ANALGESIC GROUPS IN PHARMACEUTICAL PREPARATIONS USING UV SPECTRO

**Siti Arina Mardiana[1], Delta Happy Friantina[2], Syarifa Risqina Achmad[3], Ema Aulia Fikasari[4], Zalfa Zahiyah Putri[5], Prillya Posma Meldawati Tambunan[6]**
Pharmaceutical laboratory, Department of Pharmacy,
Semarang State University, 50229 Jawa Tengah
e-mail: arinamardiana123@students.unnes.ac.id

**Abstract**

Supervision and quality inspection of pharmaceutical preparations is carried out to ensure that the ingredients in medicinal preparations have the specified quality and quantity and follow standard analysis procedures. One form of medication is generic mefenamic acid tablets. To determine the mefenamic acid content of tablets, the ultraviolet spectrophotometric method can be used. Before performing assay analysis, the analytical method must be validated to ensure that the method meets the requirements for use. The aim of this study was to determine the validity of the ultraviolet spectrophotometry method for evaluating the determination of mefenamic acid levels in generic tablets based on certain parameters. This research is descriptive and validates the ultraviolet spectrophotometry method. Monitoring and quality inspection of pharmaceutical preparations is carried out to ensure that the ingredients in medicinal preparations have the specified quality and quantity and follow standard analysis procedures.

**Keywords:** Medicinal; Spectrophotometric; Pharmaceutical

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## 1. Introduction

Instrument validation is the process of proving through laboratory analysis to deliver information about the reliability of a process used. Instrument testing is a component a project effort to assure quality to protect against the effects, quality, and safety of products used in the pharmaceutical industry. type of validation is verification of analytical methodology. [1] The purpose of analytical validity is to prove that each analytical approach (test method) used for the test and ongoing quality control. One of the drugs that is often used in mild and moderate pain relief therapy is ibuprofen. Ibuprofen is a derivative of propionic acid, ibuprofen is a group of NSAIDs with analgesic and antipyretic properties. The mechanism of action of ibuprofen is by inhibiting the enzyme cyclooxygenase by interfering with the conversion of arachidonic acid to prostaglandins. UV-Vis spectrophotometer is a measurement of the wavelength and intensity of ultraviolet and visible light absorbed by a sample.[2] Ultraviolet and visible light have enough energy to promote electrons in the outer shell to a higher energy level. UV-Vis spectroscopy is

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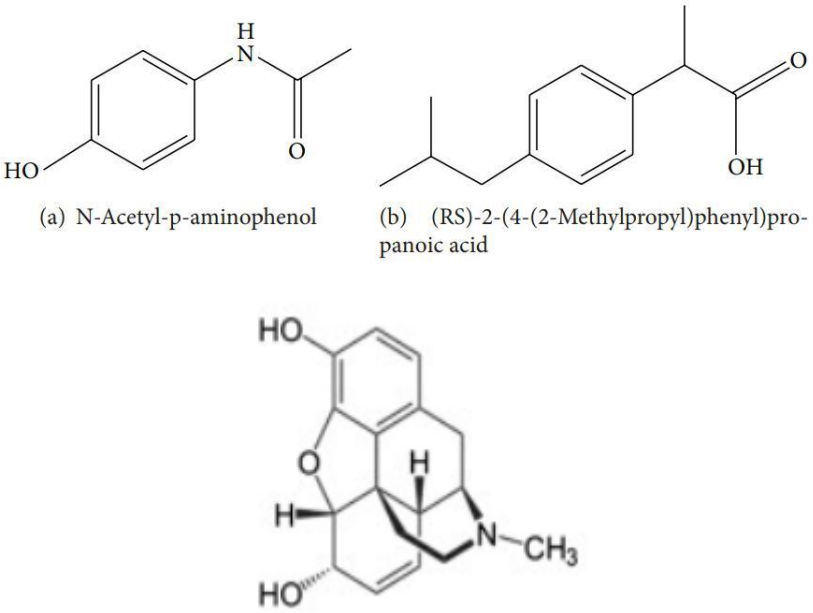
usually used for inorganic molecules and ions or complexes in solution. The UV-Vis spectrum has a wide shape and only little information about the structure can obtained from this spectrum. But this spectrum is very useful for quantitative measurements. The concentration of the analyte in solution can be determined by measuring the absorbance at a certain wavelengt using the Lambert-Beer law.[3]




(a) N-Acetyl-p-aminophenol (b) (RS)-2-(4-(2-Methylpropyl)phenyl)propanoic acid

**Figure 1.** Chemical structure of paracetamol (a) and ibuprofen (b).

Many researchers have found morphine to be a component of human metabolites. Suanite (2007) [9] uses spectrophotometry to determine the amount of morphine in urine. For the initial identification of the study, thin-layer chromatography (TLC) is used. Ethyl acetate is a solvent that works well with morphine. It contains 80 milliliters of methanol, 13 milliliters of ammonia, and 4 milliliters of ammonia. The ratio of toluene to acetone, ethanol, and ammonia is 45:45:7-3, and the maximum wavelength that can be obtained from morphine ranges from 20 to 120 ng/ml. TLC was also created by Harborne (1987) [10]. The spectrophotometry method is a clear and easy methodology for analyzing morphine.[1]

A potent opioid pain reliever, morphine is frequently used to treat extreme pain, including pain from surgery and cancer. Peak analgesia is achieved 30–60 minutes and 50–90 minutes after injection, indicating rapid absorption of morphine. Subcutaneous morphine has a half-life of three to four hours. The body contains morphine, particularly in parenchymal tissues such the kidneys, lungs, liver, and spleen. Brain and striated tissue have low amounts. Breast milk contains morphine, which diffuses across the placental barrier. Ninety percent occur in urine within 24 hours, and about 35 percent are related to proteins, particularly albumin, whose serum levels start to drop for about one and a half to two hours. The feces contains about 7–10% of the dosages, mostly through the gland. [1]

Diclofenac is a member of the cyclo-oxygenase (COX) inhibitor or nonsteroidal anti-inflammatory medication (NSAID) family. It works well as an analgesic, antipyretic, and anti-inflammatory. It is frequently used to treat osteoarthritis, rheumatoid arthritis, and both acute

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and chronic pain. It works by preventing COX activity, which results in the production of pro-inflammatory mediators such thromboxanes and prostaglandins (PGs)[1]. COX-2 inhibits the analgesic effect regimen of diclofenac sodium, resulting in a reduction in the production of anti-inflammatory prostaglandins from peachidonic acid.. [3]

**2. Paracetamol and Tramadol**

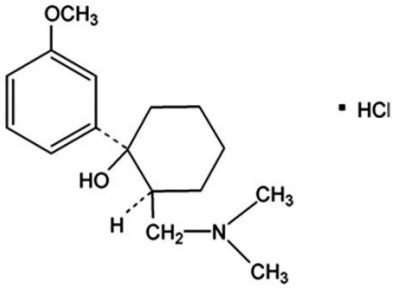


**Figure 2.** Chemical structure of Paracetamol and Tramadol

As an anti-inflammatory, acetaminophen and tramadol are typically administered together. These two medications are taken together in Indonesia as a split powder dosage form. In order to apply patient-centered treatments, it was crucial to guarantee consistency in each compound's composition. The content of paracetamol and tramadol split powder in the dose form was quantitatively analyzed using UV spectrophotometric with chemometrics techniques. This investigation included two multivariate calibration techniques: partial minimum squares (PLS) and main component regression (PCR)[4]

Both the Indian and British pharmacopoeias recognize acetaminophen as an official medication. The spectrophotometric identification of etodolac and its metabolites in biological materials is the subject of numerous studies. concurrent assessment of aceklephoenac and etodolaki. Acetaminophen was subjected to several combinations of chromatographic methods. Furthermore, etodolac and paracetamol still don't work together. In order to evaluate Etodolac and Paracetamol in tablet formulation simultaneously, we have created a straightforward, quick, accurate, repeatable, and cost-effective procedure that has been validated. The structures of paracetamol and etodolac were moved to Figures 1 and 2, respectively. [5]

**3. Naproxen**

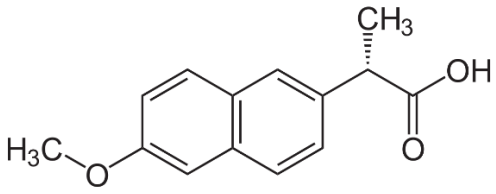


**Figure 3.** Chemical structure of Naproxen

With its anti-inflammatory, analgesic, and antipyretic qualities, naproxen [(+)-2-(6-methoxy-2-naphthyl) propionic acid, or NAP, is a nonsteroidal anti-inflammatory medication that is frequently chosen over acetylsalicylic acid (aspirin) when taken orally because of its superior absorption and fewer adverse effects. Naproxen's anti-inflammatory properties are

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typically linked to cyclo-oxygen inhibition and, consequently, a reduction in prostaglandin levels in a variety of fluids and tissues. It comes in tablet or suppository form and is used to treat acute gout, dysmenorrhea, rheumatoid arthritis, and other rheumatic or muscle conditions. In commercial formulations, naproxen was characterized using high-performance liquid chromatography (HPLC), room temperature phosphorescension due to severe atoms, UV spectrophotometry, and coulometry. The Naproxen API and tablet formulations for Scheer did not specify an HPLC-related substance technique.. [6]

**4. Phenylpropanolamine**

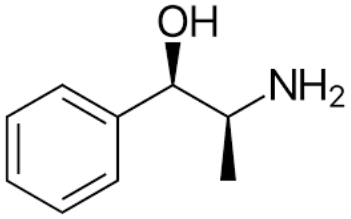


**Figure 4.** Chemical structure of Phenylpropanolamine

Pharmaceutical components in tablet dosage forms must be determined precisely in order to guarantee the efficacy and safety of drugs. Because of their synergistic effects, acetaminophen (PA), phenylpropanolamine HCl (PH), and chlorpheniramine maleate (CH) are frequently combined in tablets to treat cold and flu symptoms. Each of these substances has a unique medicinal function; for example, PA has analgesic and antipyretic properties, PH has nasal decongestant properties, and CH has antihistamine properties. The development of their simultaneous quantitative powerful analytical procedures is crucial due to their extensive use. The amounts of PA, PH, and CH have been measured in a number of published publications using techniques such as high-performance liquid chromatography (HPLC), high-performance thin layer chromatography (HPTLC), thin layer chromatography-densitometry, Spectrometry spectrophotometry.Ultraviolet (UV) spectrophotometry is a widely used analytical technique due to its simplicity, cost-effectiveness, and rapid analysis capabilities. [7]

**5. Etodolac**

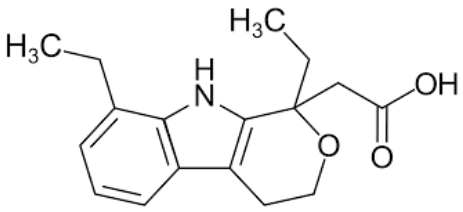


**Figure 5.** Chemical structure of Etodolac

Etodolac comes in tablet form for commercial use. This mixture is used as an antifreeze and analgesic. Both the Indian and British pharmacopoeias recognize acetaminophen as an official medication. The simultaneous assessment of etodolaki and aceklephoenac is one of the studies that focus solely on the spectrophotometric identification of etodolac and its metabolites in biological materials. The combination of etodolaki and paracetamol has not yet been tested

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using any of the chromatographic techniques that have been used on paracetamol. In order to evaluate Etodolac and Paracetamol in tablet formulation simultaneously, we have created a straightforward, quick, accurate, repeatable, and cost-effective procedure that has been validated. The structures of paracetamol and etodolac were moved to Figures 1 and 2, respectively. [8]

**6. Ibuprofen**

Ibuprofen is an analgesic drug from the Non-Steroid Anti-Inflammatory drugs (NSAIDs) group derived from arylacetic acid. This drug is mainly used to reduce pain due to inflammation in various rheumatic and arthritis conditions. Ibuprofen produces analgesic effects by directly and selectively inhibiting enzymes in the central nervous system that catalyze prostaglandin biosynthesis such as cyclooxygenase. This inhibition prevents pain receptor sensitization by pain mediators such as bradykinin, histamine, serotonin, prostacyclin, prostaglandins, hydrogen and potassium ions that can stimulate pain mechanically or chemically.[9]

**7. Piroxicam and Codeine Phosphate**

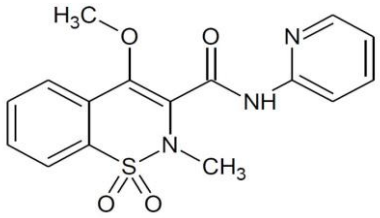


**Figure 6.** Chemical structure of Piroxicam


**Figure 7.** Chemical structure of Codein Phospate

Piroxicam is a drug classified as a non-steroidal anti-inflammatory drug (NSAID) having an antipyretic and analgesic characteristic. It is used to treat rheumatic diseases such as inflammation, pain from injury, menstrual cramps, arthritis, musculoskeletal disorders, and non-rheumatic diseases such as biliary and ureteral colic, dysmenorrhea inflammation and fever. . Piroxicam has an oxime group and N-heterocyclic carboxamide. Piroxicam has an IUPAC name (4- Hydroxy-2-methyl-N-(2-pyridinyl)-2H-benzothiazine-3-carboxamide 1,1-dioxide), it is white to light yellow, crystalline powder with a molecular weight of 331.35 g/mol and practically insoluble in water, Codeine Phosphate is an opioid derived from the immature poppy seed plant (Papaver somniferum). It has a phenolic hydroxyl group with a methyl substitution and has a morphine-like structure. The chemical description of the phosphate salt form is Didehydro-alpha-epoxy-3-methoxy-17-methylmorphinan-6 alpha-ol phosphate hemihydrate and the molecularn

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form is C18H24NO7P·½H2O. Codeine has one chiral center. Codeine has a molecular weight of 406.4 g/mol.

**8. Propifenazon**

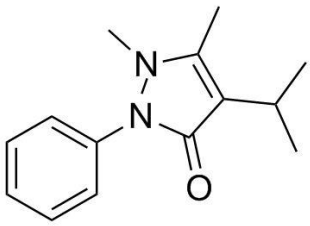


**Figure 8.** Chemical structure of Propifenazon

Most of the drugs on the market are a combination of several active ingredients, each of which aims to increase the therapeutic effect of the drug and ease of use (Naid et al, 2011). Tablets containing paracetamol (PCT), propyphenazone (PRO) and caffeine (KOF) are the most widely used combination to relieve pain. PCT, PRO and KOF in combination cause a reduction in the amount of prostaglandins, while KOF is also known to increase the analgesic effect of PCT and KOF synergistically, the benefits of this drug combination can reduce headaches, muscle pain, neuralgia, back pain, joint pain, rheumatic pain, migraines, toothaches and menstrual pain. This combination has also been shown to be effective for fevers caused by bacterial or viral infections, with limited side effects and this combination is suitable for all ages.[10]

**Table 1.** Instrumental analysis parameters, sample preparation techniques, recovery values and LODs of the developed GC methods

| HPLC | Matrix | Sample Preparation | Gc Parameters | Detector | Loq (Mg/Ml) | Recoveries | Ref |
|---|---|---|---|---|---|---|---|
| Propifenazon | Plasma | PLS | Optimization was carried out by measuring the absorption produced by PCT, PRO and KOF in methanol, phosphate buffer pH 7.2, a mixture of phosphate buffer pH 7.2 and methanol with a ratio of 90:10; 70:30; 50:50; 30:70; 10:90 | PCR | 10-25 | NM | [10] |
| Parasetamol, | Enzim | RCsB | The ligands used are paracetamol, phenacetin and acetanilide and COX 2 (PDB ID 6COX) as receptor with Autodock Vina 1.5.7 ver as software. As in previous research, the | PDB | 60-62 | 20% | [5] |

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| | | | catalytic residues of the cyclooxygenase 2 (COX 2) enzyme are Arg120, Tyr355, Tyr385, and Ser353 (Miladiyah et al., 2017). The docking results obtained were compared with the control ligand, namely 2-acetamido-2-deoxy-beta-d-glucopyranose (NAG). | | | | |
| Morphine | Plasma | KCKT | A phosphate buffer solution is prepared by mixing 125 mL of 0.2 M potassium dihydrogen phosphate with 111.25 mL of 0.2 N sodium hydroxide. The solution was diluted with aquabidestylate to 500.0 mL. The pH of the solution was adjusted until it reached pH 7.0 | RSD | 20-100 | 90% | [9] |
| Mefenamic Acid | Plasma | UV | The ligands used are paracetamol, phenacetin and acetanilide and COX 2 (PDB ID 6COX) as receptor with Autodock Vina 1.5.7 ver as software. As in previous research, the catalytic residues of the cyclooxygenase 2 (COX 2) enzyme are Arg120, Tyr355, Tyr385, and Ser353 (Miladiyah et al., 2017). The docking results obtained were compared with the control ligand, namely 2-acetamido-2-deoxy-beta-d-glucopyranose (NAG). | RSD | 50-100 | 99% | [11] |
| Tramadol | Plasma | PCR | Twenty single doses of divided powder dosage forms were weighted for each and homogenized accordingly. A 50 mg powder for every | PLS | NM | NM | [4] |

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| | | | single dose was weighed, transferred into 50 mL volumetric flask, diluted with methanol into the volume, and filtered to remove drug excipients. A 500 µL filtrate was transferred into 10 mL volumetric flask followed by dilution into the volume | | | | |
| Aspirin | Plasma | FTIR | For the ultraviolet analysis, the procedure was as it follows: a sample amount equivalent to 0,01 g pure aspirin from the tablets was dissolved in 10 ml sodium hydroxide 0,1 N, in volumetric flask, 1 ml of this solution was diluted with 0.1N sodium hydroxide to 10 ml. The solutions' spectra were measured at 299 nm (+1), compared to the 0,1 N sodium dioxide. The FTIR spectra were obtained using KBr pallets, in the range 4000 and 400 cm-1 with a cm-1 resolution | UV-VIS | NM | NM | [12] |
| Phenylpropanolamine | Plasma | CLS | 5 µm RP-18 column (250 x 4.6 mm), pH 6.5 013 mM phosphate buffer- methanol (40:60 v/v) as a mobile phase at a flow rate of 1.0 mL/min and UV detection 258 nm. The developed methods were validated for their linearity, accuracy, precision, limit of detection (LOD) and limit of quantitation (LOQ) in comparison with the UV | UV | 170-512 | 80% | [7] |

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| | | | spectrophotometric method. T | | | | |
| Paracetamol | Blood | UV/Visible | Ultrasonic Bath Digitals (ELMA Type D-78224), Column μ Bondapak TM C18 10 μm 125A 3.9 x 300 mm, UV-Vis Spectrophotometer (Agilent 8453), Digital Balance (Sartorius), 0.45μm Filter (Phenex NY), and Glassware (Pyrex) | RSD | 2--100 | 90% | [13] |
| Celecoxib | Plasma | FDA | LAF until 1 mL remains, then centrifuged for 5 minutes at 5000 rpm. The supernatant obtained was added with 10 μL of BSTFA, heated at 60oC for 30 minutes | ICH | NM | NM | [14] |
| Paracetamol | Plasma | SPE | 0.5 mL of plasma was added to 50 μL of SI stock solution (Atorvastatin) and vortexed for 1 min before and after adding 50 μL of 25% acetic acid. Then 3.0 mL (tert-butyl methyl ether) was added and vortexed for 3 min. | SPE | NM | NM | [15] |
| Aspirin | Plasma | UV-Vis | Aspirin mother liquor, salicylic acid, and Benzoic acid was prepared by weighing 10 mg aspirin, 10 mg salicylic acid, and 10 mg benzoic acid each. Each substance was put into 3 different 10.0 mL measuring flasks, added acetonitrile to the mark, and shaken until dissolved. | CV | 1,5-2,5 | 60% | [16] |
| Chlorpheniramine | Blood | UV | High-Performance Liquid Chromatography (HPLC) with ultraviolet/fluorescence detection, Supercritical Fluid | CLS | 7-19 | 98% | [7] |

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| | | | Chromatography-mass spectrometry (SFC-MS/MS), Liquid Chromatography-tandem mass spectrometry (LC-MS/MS), Capillary Zone Electrophoresis (CZE) with detection ultraviolet, and Micellar Electrokinetic Chromatography-electrospray ionization–mass spectrometry (MEKC-ESI–MS). | | | | |
| Aspirin | Enzim | Uv | Agilent C18 provides the best results with a flow rate of 1 ml/min and UV detection of 240 nm. HPLC parameters were evaluated with six repeated injections of drug solution (40 μg/mL). The method was validated according to ICH guidelines, checking linearity, accuracy, precision, specificity, limit of quantification, limit of detection, and robustness | ICH | 40-60 | 99% | [12] |
| Ketoprofen | Plasma | KCKT | 5 μm RP-18 column (250 x 4.6 mm), pH 6.5 013 mM phosphate buffer- methanol (40:60 v/v) as a mobile phase at a flow rate of 1.0 mL/min and UV detection 258 nm. The developed methods were validated for their linearity, accuracy, precision, limit of detection (LOD) and limit of quantitation (LOQ) in comparison with the UV spectrophotometric method. T | RSD | 2-50 | 75% | [17] |

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| sodium salicylate | Plasma | CMT | The effect of SS at two concentration levels (0.3 and 3.0 M) on the solubilisation of the water-insoluble dye, Sudan III, by SDS was deter-mined at 26°C. After an equilibration period of 72 h, samples were filtered using 0.45 pm Milli-pore discs, suitably diluted with 0.1 N NaOH and the absorbance determined at 507 nm using a Unicam SP 1800 spectrophotometer. | CMC | NM | NM | [18] |
| Phenylbutazone | Enzim | RCsB | Optimization of phenylbutazone levels was carried out at a concentration of 0.1%; 0.15%; 0.2%; and 0.25%. The optimum formula was obtained at a concentration of phosphatidylcholine 3% and ethanol 35% prepared by the hot method | PDB | 20-100 | NM | [19] |
| Parasetamol | Plasma | UV | For precision validation, the average % recovery of paracetamol and caffeine test solutions was 100.01758% and 97.42951907%, respectively. The LOD and LOQ values obtained were 26.74885159 ng/10µL and 89.162838 ng/10µL respectively. The concentration of the paracetamol sample solution was 998.226 ng/10µL. | RSD | NM | NM | [20] |

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In 2018, researchers Harrizul Rivai The development of this method is also compared with the general ultraviolet spectrophotometry method, namely the absorbance method. The samples used were Pronalges® tablets (PT Dexa Medica) and Ketoprofen tablets (PT Novell). The results obtained the best solvent is urea 2 M. The maximum wavelength of ketoprofen in urea 2 M is 260.80 nm. Measurement of the area under the curve was carried out at a wavelength of 235.80-308.20 nm. Validation of the analysis method shows that both methods meet the requirements of the analysis method validation parameters. The percentage of ketoprofen tablet content meets the requirements of the Indonesian Pharmacopoeia edition V, namely 92.5-107.5%. [17]

In 2015 research by Tulandi The results of the analysis validation obtained precision and accuracy of the method that met the analysis validation requirements, namely for the standard deviation (SD) value of 0.0595; coefficient of variation (CV) of 0.0048 and method accuracy of 99.0795%. A linearity value of r = 0.9982 was obtained with a detection limit of 1.4684 ppm and a quantitation limit of 4.8945 ppm. The average results of the determination of generic and branded paracetamol levels were 3.034 ± 0.294 ppm; 3.049 ± 0.070 ppm; 3.019 ± 0.199 ppm; 3.079 ± 0.139 ppm, respectively.[15]

In 2019, Pulungan et al. In this study, analysis of Principal Component Regression (PCR) and Absorbance Ratio (RA) spectrophotometric methods will be carried out to determine levels of PCT, PRO and KOF in tablet preparations without any separation stage, so that this method is expected to be applied routinely by interested parties. The recovery test is carried out by measuring the percentage of recovery in three specific ranges, namely: 80%, 100% and 120%. Where in each specific range, 70% of the samples (PCT, PRO and KOF) were analyzed and 30% came from the added standard. Then the sample (tablet) and standard mixture were analyzed by the same procedure as for the sample. [10]

In 2024, Rena et al. The research results obtained the maximum wavelength of paracetamol 255 nm, and 3 samples of herbal medicine for aches and pains that were positive for containing the chemical drug (BKO) paracetamol, the levels obtained were sample A 1.94%, sample B 5.45%, and sample C 2.36%.[20]

A true-experiment approach, or pure experiment, was used in this study by Diningsih et al. in 2024. It was conducted in the Chemistry lab at the University of Aufa Royhan in Pa-dangsidimpuan City. The samples were randomly selected medication pills that contained paracetamol and were sold in Padangsidimpuan City. The findings indicate that the paracetamol content of six distinct samples is 511 mg, 538 mg, 220 mg, 448 mg, 527 mg, and 448 mg, respectively, in paracetamol tablets. Paracetamol levels in each sample recovered at a percentage of 102.2% in sample A, 107% in sample B, 90% in sample C, 91% in sample D, 106% in sample E, and sample F is 90%. Percentage of paracetamol in paracetamol tablet preparations meets the requirements of the Indonesian Pharmacopoeia VI edition of 2020, namely not less than 90% and not more than 110%. The sugges-tion from this research is to analyze the drug content of other types of preparations. [21]

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In 2023, Ramadhan et al. effectively used three spectrophotometric techniques to estimate the co-formulated Celecoxib and Tramadol in their tablets: dual-wavelength resolution technique (method III), induced dual-wavelength technique (method II), and second derivative 2D-spectrophotometry technique (method I). The International Council for Harmonization (ICH) guidelines were successfully followed in the validation of the suggested procedures, which were then statistically evaluated using correlation coefficients, relative standard deviations, detection limits, and quantitation limits. The variance ratio F test and the student t test showed non-significant discrepancies between the actual findings and the reported results. Additionally, the analytical eco-scale approach was used to further evaluate the implemented techniques' greenness, yielding an exceptional green scale with a final score of 95. The suggested spectrophotometric methods might. [14]

As an anti-inflammatory drug, paracetamol and tramadol were frequently administered together in 2020, according to Christin et al. These two medications were combined and made into a divided powder dose form in Indonesia. To use the patient-oriented treatment, it was crucial to guarantee the consistency of each compound's composition. The concentration of paracetamol and tramadol in divided powder dosage form was quantitatively analyzed using chemometrics and UV spectrophotometrics. Principal component regression (PCR) and partial least squares (PLS), two multivariate calibration techniques, were used in this investigation. After taking into account a number of statistical metrics, including the root mean, coefficient of determination (R2), square error of calibration (RMSEC), root mean square error of cross-validation (RMSECV), and root mean square error of prediction (RMSEP), the PLS model was chosen to be employed for determining the content of paracetamol and tramadol. The linear model for determining content of paracetamol and tramadol were y = 0.9877x + 0.4663 (R2=0.9959) and y = 0.9685x + 0.3401 (R2 =0.9875), respectively. The chemometrics model was applied in the content uniformity analysis of divided powder dosage form samples.[4]

## 9. Discussion

The ideas The proposed methods were successfully validated following the International Council for Harmonisation (ICH) guidelines and statistically assessed based on the correlation coefficients, relative standard deviations as well as detection and quantitation limits. The obtained results revealed non-significant differences compared to the reported results as revealed by the variance ratio F test and Student t test. It was important to ensure the content uniformity of each compound to implement the patient-oriented medication. UV spectrophotometric combined with chemometrics techniques were developed to quantitatively analyze the content of paracetamol and tramadol in divided powder dosage form. Two multivariate calibration method namely principal component regression (PCR) and partial least squares (PLS) were applied in this study. Three spectrophotometric methods were efficiently applied to estimate the co-formulated Celecoxib and Tramadol in their tablets; second derivative

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2D-spectrophotometry technique (method I), induced dual-wavelength technique (method II) and dual-wavelength resolution technique (method III). The proposed methods were successfully validated following the International Council for Harmonisation (ICH). UV spectrophotometric combined with chemometrics techniques were developed to quantitatively analyze the content of paracetamol and tramadol in divided powder dosage form. Two multivariate calibration method namely principal component regression (PCR) and partial least squares (PLS) were applied in this study.

**10. Conclusions**

A UV spectrophotometric coupled with multivariate calibration method for simultaneous determination of paracetamol and tramadol in divided powder dosage form has been successfully conducted. PLS was chosen as multivariate calibration technique for determining both paracetamol and tramadol. It can be concluded that divided powder dosage forms compounded by the pharmacist in Yogyakarta, Indonesia do not have a good uniformity in content both paracetamol and tramadol. This developed method was rapid, simple, low cost, and effective for routine analysis of divided powder dosage form. However, it is important to redevelop the multivariate calibration models for different formulation. Pharmaceutical assay was carried out using spectrophotometer on all brands of diclofenac sodium tablets during the study. Table-1 shows name brand and % assay of different brands. Our results reveal that among all the four brands of diclofenac sodium (Dicloran, Defnac, Artifin, voltral) Defnac and voltral shows highest percentage assay 104% and Dicloran shows lowest value for percentage assay 96.4%, while artifin shows a percentage assay of 98.6%..

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**References**

[1] Z. Alfian, H. Marpaung, M. Taufik, R. Harahap, and C. Simanjuntak, "Detection and identification of morphine in blood of male white rats (rattus norvegicus) by ultraviolet-visible spectrophotometry," *J. Phys. Conf. Ser.*, vol. 1116, no. 4, 2018, doi: 10.1088/1742-6596/1116/4/042004.

[2] N. Karnakar, "Machine Translated by Google Machine Translated by Google Pengembangan metode analisis dan validasi natrium diklofenak dengan spektroskopi UV-visibel menggunakan metode AUC," 2020.

[3] S. Naveed and F. Qamar, "UV spectrophotometric assay of Diclofenac sodium available brands," *J. Innov. Pharm. Biol. Sci.*, vol. 1, no. 3, pp. 92–96, 2014.

[4] D. Christin, A. Putri, M. R. Gani, and F. D. Octa, "Chemometrics-Assisted UV Spectrophotometric Method for Simultaneous Determination of Paracetamol and Tramadol in Divided Powder Dosage Form," *Int. J. Pharm. Res.*, vol. 13, no. 01, pp. 1901–1907, 2020, doi: 10.31838/ijpr/2021.13.01.075.

[5] Nofita, R. Dayanti, Tutik, and Supardi, "Penetapan Kondisi Optimum Pengujian Kadar Parasetamol Dan Kafein Dengan Kromatografi Cair Kinerja Tinggi," *J. Farm.*

2024, Vol. 9 No 4
PP 25-31
Prefix DOI 10.5455/mnj.v1i2.644xa

*Malahayati*, vol. 1, no. 2, pp. 96–106, 2018.

[6] P. Mehta, C. Sharma, D. Nikam, and M. Ranawat, "Development and Validation of Related Substances Method by HPLC for Analysis of Naproxen in Naproxen Tablet Formulations," *Int. J. Pharm. Sci. drug Res.*, vol. 4, no. 1, pp. 63–69, 2012.

[7] R. E. Tarigan, N. Sajida, and C. Surbakti, "Advanced UV Spectrophotometry-Classical Least Squares Determination of Paracetamol, Phenylpropanolamine HCl, and Chlorpheniramine Maleate in Tablet Dosage Form," *Int. J. Sci. Technol. Manag.*, vol. 5, no. 4, pp. 985–990, 2024, doi: 10.46729/ijstm.v5i4.1150.

[8] V. Siva Rama Krishna, S. Belemkar, and R. N. Tiwari, "RP-HPLC method development and validation of etodolac and paracetamol in tablet dosage form," *Int. J. PharmTech Res.*, vol. 6, no. 2, pp. 775–782, 2014.

[9] Asiva Noor Rachmayani, "DETERMINATION OF IBUPROFEN TABLETS IN WISTAR RAT PLASMA MATRIX BY HPLC," p. 6, 2015.

[10] A. F. Pulungan, "… Dan Kofein Secara Spektrofotometri Ultraviolet Dengan Metode Principal Component Regression Dan Rasio Absorbansi Tahun …," *JIFI (Jurnal Ilm. Farm. Imelda)*, vol. 2, no. 2, pp. 82–88, 2019, [Online]. Available: https://jurnal.uimedan.ac.id/index.php/JURNALFARMASI/article/view/203

[11] S. Musiam and R. Alfiian, "Validasi Metode Spektrofotometri UV pada Analisis Penetapan Kadar Asam Mefenamat dalam Sediaan Tablet Generik," *J. Ilm. Ibnu Sina*, vol. 2, no. 1, pp. 31–43, 2017.

[12] G. Motan and A. Puia, "Studies of different types of aspirin by spectrophotometric methods," *Acta Chem. Iasi*, vol. 22, no. 2, pp. 155–164, 2014, doi: 10.2478/achi-2014-0013.

[13] D. Muldianah, S. Sulastri, A. Fatharani, D. A. Nurdimayanthi, D. S. Rahmawati, and H. Fadhilah, "Metode Analisis Paracetamol (Acetaminophen) dalam Darah, Plasma, Dan Serum Manusia," *Comserva*, vol. 2, no. 1, pp. 1–12, 2022, doi: 10.59141/comserva.v2i1.202.

[14] H. S. Ramadan, R. A. A. Salam, G. M. Hadad, F. Belal, and M. M. Salim, "Eco-friendly simultaneous multi-spectrophotometric estimation of the newly approved drug combination of celecoxib and tramadol hydrochloride tablets in its dosage form," *Sci. Rep.*, vol. 13, no. 1, pp. 1–12, 2023, doi: 10.1038/s41598-023-38702-9.

[15] G. P. Tulandi, S. Sudewi, and W. A. Lolo, "Validasi Metode Analisis Untuk Penetapan Kadar Parasetamol Dalam Sediaan Tablet Secara Spektrofotometri Ultraviolet," *PHARMACON J. Ilm. Farm.*, vol. 4, no. 4, pp. 168–178, 2015.

[16] A. Siswanto, A. Fudholi, A. K. Nugroho, and S. Martono, "Validasi Metode HPLC untuk Penetapan Aspirin dan Asam Salisilat dalam Plasma Kelinci ( Lepus curpaeums ) secara Simultan Validation of A High Performance Liquid Chromatography Method for The Simultaneous Determination of Aspirin and Salisylic Acid In Rabb," *J. Kefarmasian Indones.*, vol. 6, pp. 68–78, 2016.

[17] L. Daerah, K. Secara, S. Ultraviolet, H. Rivai, and B. Chandra, "Pengembangan dan Validasi Metode Analisis Ketoprofen Tablet dengan Metode Absorbansi dan Luas

[18] L. K. El-Khordagui, "Effect of sodium salicylate on the solution properties of

2024, Vol. 9 No 4
PP 25-31
Prefix DOI 10.5455/mnj.v1i2.644xa

sodium dodecyl sulphate," *Int. J. Pharm.*, vol. 83, no. 1–3, pp. 53–58, 1992, doi: 10.1016/0378-5173(82)90007-2.

[19] N. I. Akib, M. H. Sahumena, Y. Dawu, V. Aspadiah, I. Hafizah, and H. Ritonga, "Optimasi Kadar Fenilbutazon dalam Pembawa Vesikular Etosom," vol. 7, no. April, pp. 88–96, 2020.

[20] M. Rena, L. Nurlaeli, and L. Suryanti, "Analisis Kandungan Parasetamol pada Jamu Pegal Linu di Wilayah Cilodong dengan menggunakan Spektrofotometri Uv-Vis," *Open Access Jakarta J. Heal. Sci.*, vol. 3, no. 7, pp. 1327–1334, 2024, doi: 10.53801/oajjhs.v3i7.288.

[21] A. Diningsih, E. S. Hasibuan, N. A. Rangkuti, H. Y. Harahap, and A. Syahadat, "Analisis Kadar Parasetamol Dalam Sediaan Tablet Dengan Menggunakan Spektrofotometer Uv-Visible," *Forte J.*, vol. 4, no. 2, pp. 354–359, 2024, doi: 10.51771/fj.v4i2.914.