# A REVIEW OF ANALYTICAL AND BIO-ANALYTICAL TECHNIQUES FOR DICLOFENAC SODIUM ESTIMATION

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## ABSTRACT

Various Analytical and Bio-analytical techniques for the estimation of Diclofenac Sodium (DFS), a widely used non-steroidal anti-inflammatory drug (NSAID) globally, have been reviewed.

## 1.INTRODUCTION

Rapid advances have been made in many analytical techniques relevant to pharmaceuticals over the past decade. The quality control of pharmaceuticals has become of utmost importance and these have driven the development of analytical techniques. Pharmaceutical analysis covers aspects of the theory and application of the most common analytical methods used in the elucidation of the structure of simple molecules which are directly applicable to pharmaceutical drug analysis. The purpose of the here-presented article is to present an overview of analytical and bio-analytical techniques developed for the estimation of Diclofenac Sodium (DFS), a widely used non steroidal anti-inflammatory drug (NSAID) (Hanumath,2010).

A review of literature reveals that the following analytical and bio-analytical techniques are in currency: (1)Amperometry, (2) Capillary Zone Electrophoresis , (3) Chemometric Techniques, (4) Densitometry, (5) Diffuse Reflectance Photometry, (6) Electron-Capture Gas-Liquid chromatography, (7) Electrospray Ionization–Ion Trap Mass Spectrometry, (8) Fluorimetry, (9) Fourier Transform Raman Spectroscopy, (10) Fast Fourier Transform Square Wave Voltametry (FFT SWV), (11) Gas Chromatography, (12) High Performance Liquid Chromatography, (13) High Performance Liquid Chromatography-Mass Spectrometry, (14) High Performance Thin layer Liquid Chromatography, (15) Near-Infrared Spectroscopy, (16) Potentiometry, (17) Proton Magnetic Resonance, (18) Spectrophotometry, (19) Spectrofluorometry, (20) Supercritical Fluid Chromatography, (21)Thin Layer Chromatography.

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The principles of these techniques are briefed hereunder.

Amperometry is an electroanalytical technique in which the potential of the indicator electrode is adjusted to a fixed value on the plateau of the polarographic or voltametric wave of an electroactive species and the current flowing through the electrode is measured as a function of concentration (Braun,2006).

In Capillary Zone Electrophoresis the applied potential causes the different ionic components of the mixture to each migrate according to its own mobility and to separate into zones that may be completely resolved or may be partially overlapped (Skoog,2004).

Chemometrics is a science where chemistry and pharmaceutical science meet statistics and software. The primary focus of chemometrics involves the use of mathematical or software procedures in particular, both to develop analytical methods and to analyze the signals and results obtained (Ghasemi,2005).

Densitometry is the quantitative measurement of optical density in light-sensitive materials, such as photographic paper or film, due to exposure to light. Optical density is a result of the darkness of a developed picture and can be expressed absolutely as the number of dark spots in a given area, but usually it is a relative value. Since density is usually measured by the decrease in the amount of light which shines through a transparent film, it is also called adsorptiometry, the measure of light absorption through the medium. The corresponding measuring device is called densitometer (Jan and Malgorzala,2002).

Diffuse Reflectance Photometry is an excellent sampling tool for powdered or crystalline materials in the mid-IR and NIR spectral ranges. It can also be used for analysis of intractable solid samples (Tubino and Desouza,2006).

Gas Chromatography is basically a separation technique in which the compounds of a vaporized sample are separated and fractionated as a consequence of partition between a mobile gaseous phase and a stationary phase held in column. The partition takes place between a gas and liquid or gas or solid. In Gas Liquid Chromatography, the mobile phase is a gas such as helium and the stationary phase is a high boiling point liquid absorbed onto a solid (Sharma,2007).

Electrospray Ionization mass Spectroscopy is the techniques for analysis of biomolecules, such as polypeptides, proteins and oligonucleotides having molecular weights of 100,000 Da or more. This method is beginning to find application to the characterization of inorganic species and synthetic polymers (Skoog,2004).

In Fluorimetry, a beam of light is incident on certain substances, they emit visible light or radiation which is known as fluoroscence and the substances showing this phenomenon are known as fluorescent substances. The phenomenon of fluorescence is instantaneous and starts immediately after the absorption of light and stops as soon as the incident light is cut off (Gurudeep,2008).

Fourier Transform Raman Spectroscopy shows considerable promise as a new characterization technique for molecules which contain chromophores which absorb in the visible region, the region where conventional Raman measurements are made. With the use of near-infrared excitation, spectra in the absence of fluorescence and resonance enhancement are obtained (Mazurek and Szostak,2008).

Fast Fourier Transform Square-Wave Voltametry (FFT SWV) is based on measurements of electrode admittance as a function of potential. The response of the detector (microelectrode), which is generated by a redox processes, is fast, which makes the method suitable for most applications involving flowing electrolytes (Daneshgar,2009).

High Performance Liquid Chromatography is based on the sophisticated instruments operating at high pressure, which contrasted markedly with the simple gas columns of classic gravity-flow liquid Chromatography.High Performance Liquid Chromatography/Mass Spectroscopy is particularly attractive because HPLC can handle non-volatile and thermally sensitive compound (Skoog,2004).

In High Performance Thin Liquid Chromatography, the particle size of the stationary phase is same as HPLC (5 to 10µm). The decreased particle size compared with that used in normal thin layer chromatography increases the efficiency of separation. Silica gel is usually used as the stationary phase (Abdel,2001).

Near - Infrared spectroscopy utilizes the region of spectrum extending from the upper wavelength end of the visible region at about 770nm to 2500nm (13000 to 4000$cm^{-1}$) (Sharma,2007).

Potentiometry is an analytical technique in which the amount of substance in solution is determined, either directly or indirectly, from measurement of electromotive force (emf) between two probes (electrodes) that are dipped into the solution (Robert,2006).

PMR Spectra Proton nuclear magnetic resonance (1H-NMR) spectroscopy is a powerful tool for the structural elucidation and characterization of body fluid metabolites in inherited metabolic disorders. The technique is rapid, requiring minimal sample treatment (Adrian,2004).

Spectrophotometry is a division of absorptiometry that is concerned specifically to the use of the spectrophotometer (Sharma,2007).

Spectrofluorometry device is used in fluorescence spectroscopy to increase the selectivity of fluorometry by passing emitted fluorescent light through a monochromator to record the fluorescence emission spectrum (Arancibia,2000; Damiani,1999; Carreira,1995).

Super Critical – Fluid chromatography is more versatile than high performance liquid chromatography, more cost-efficient, user friendly, with higher throughput, better resolution and faster analysis times than general liquid chromatographic methods. The instrumentation that is required for supercritical fluid chromatography is versatile because of its multi-detector compatibility. Due to this, supercritical fluid chromatography has formed a niche in the pharmaceutical industry (Patil,1998).

Thin layer chromatography is a chromatography technique used to separate mixture. It is performed on a sheet of glass, plastic or aluminium foil, which is coated with a thin layer of adsorbent material, usually silica, aluminium oxide or cellulose. This layer is known as the stationary phase (Sun and Fabre,1994).

## 2.CONCLUSION

This review reveals that various techniques, from simple colorimetry to sophisticated Fast Fourier Transform Square Wave Voltametry, have been developed for the estimation of Diclofenac Sodium.

## Analytical Techniques

| S.No. | Estimation Methods | Samples Analysed | References |
|---|---|---|---|
| 1 | Amperometry | Various Pharmaceutical Formulations | Jose, 2007 |
| 2 | Chemometric techniques | Different Pharmaceutical Formulations | Ghasemi, 2005 |
| 3 | Densitometry | Tablets | Jan,2002 |
| 4 | Diffuse Reflectance Photometry | Tablets | Tubino,2006 |
| 5 | Electrospray Ionization-Ion Trap Mass Spectroscopy | Tablets | Galmier,2005 |
| 6 | Fluorimetry | Pharmaceutical Preparations | Carreira,1995 |
| 7 | Fourier Transform Raman Spectroscopy | Tablets & Capsules | Mazurek,2008 |
| 8 | High Performance Liquid Chromatography | Tablets | Sastry,1988; Kasperek,2008; Gonzalez,1999; Plavsic,1986; Ramana Rao,1990 |
| 9 | High Performance Liquid Chromatography – Mass Spectrometry | Tablets | Abdel,2001 |
| 10 | Near-infrared spectroscopy | Various Pharmaceutical Preparations | Wang,2009 |
| 11 | Potentiometry | Tablets | Shamsipur,2005; Santini,2006; Hassan,2005 |
| 12 | Proton Magnetic Resonance | Tablets | Fattah,1988 |
| 13 | Spectrophotometry | Tablets | Desouza,2005; Matin,2005; Sena,2004; Palomo,1999; Micalizzi,1998; Agatonovic,1997; Perez,1997; Botello,1995; Kamath,1994; Agrawal,1991; Sastry,1987; Harland,1988; Agrawal,1988; Sane,1986 |
| 14 | Spectrofluorometry | Tablets & Ointments | Arancibia,2000; Damiani,1999; Carreira,1995 |
| 15 | Supercritical Fluid Chromatography | Tablets | Patil,1998 |
| 16 | Thin layer chromatogaphy | Tablets | Sun,1994 |

## Bio-analytical Techniques

| S.No. | Estimation Methods | Samples Analysed | References |
|---|---|---|---|
| 1 | Capillary Zone Electrophoresis | Urine | Jin,2000 |
| 2 | Electron Capture Gas Chromatography | Urine | Schweizer,1980 |
| 3 | Fast Fourier Transform Square Wave Voltametry | Urine & Serum | Danashgar,2009 |
| 4 | Gas chromatography | Urine & Plasma | Schneider,1981; Schneider,1986; Siou,1991; Geiger,1975 |
| 5 | High Performance Liquid Chromatography | Plasma | Plavsic,1986; Arcelloni,2001; Giagoudakis,1998; Chan,1982 |
| 6 | High Performance Thin layer Liquid Chromatography | serum | Lala,2002 |
| 7 | Spectrophotometry | Urine | Garcia,1998 |

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